ELECTRICAL REVIEW

28th MARCH, 1952

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Exports to America

FOREIGN endeavours to increase exports to the United States are not favourably regarded by American manufacturers—an attitude which is quite understandable but one which raises difficulties for the would-be foreign supplier. A recent instance quoted by the *Electrical World* may be indicative of the state of affairs as it affects, among others, British manufacturers. Tenders were called for two 15,000 kW generators for the Bureau of Reclamation's Eklutna Project in Alaska. The lowest offer ($556,217) was received from the American representatives of the Swiss Oerlikon concern and was accepted; the English Electric Co., Ltd., bid $608,372; and the lowest American tender was from the Elliott Co. ($673,389). The foreign offers included 15 per cent import duty and were at firm prices, whereas the American tender included an " escalator " clause.

Under the " Buy American " Act of 1933, governing Federal authorities' contracts, if a domestic manufacturer's price is not more than 25 per cent higher than the lowest foreign tender the contract must be awarded to him (presumably if the offers are otherwise on level terms). Before hearings held by the Interior Department the unsuccessful American tenderer in the case quoted protested that the 25 per cent " differential " was insufficient. Figures were presented by the National Electrical Manufacturers' Association showing that the average earnings of manufacturing workers in the United States for 1950 were far higher than in the United Kingdom and other European countries. Protests were also entered by the trade union representing the workers at the Elliott plant.

The " official " view, expressed by Assistant Secretary of State Willard L. Thorp, was that other countries must be able to sell their goods to the United States to earn the dollars necessary to purchase American products. He therefore noted the award of the contract to the Swiss firm " with pleasure." The National Electrical

Manufacturers' Association contends that the award of contracts to foreign manufacturers will weaken the industry (which is vital to defence), reduce man-hours and wages and could lead to unemployment or loss of skilled personnel. Statistics of United States electrical exports and imports demonstrate how small are the latter in comparison with the former and how exaggerated are the American manufacturers' fears. Nevertheless it is plain that adverse influences are at work to make the way of the British electrical exporter very difficult. We can only hope that the American Government will continue to favour freer trade and convince its industrialists that we shall not put them out of business.

SMALL FRY

The utilization of supplementary power sources brings difficulties—technical in some cases, economic in all—and none offers rich returns within a short time, Mr. C. W. Marshall pointed out in introducing his Royal Society of Arts paper, which is reviewed in this issue. Nevertheless, as more normal sources tend to become insufficient to meet increasing demands for electricity throughout the world, such minor aids will no doubt have to receive serious consideration, but as projects remote in time, as the author emphasized, which should not be allowed to divert attention from the present need to develop the major means of generation.

"ECONOMIC PRICE"

Statements inspired by those who aim at depriving the public of electricity or at least of making it difficult for them to use it are increasing. The political correspondent of one provincial paper says that "Ministers are understood to be considering the necessity of further increasing electricity prices" and reference is made to "economic prices for various users." Quite apart from the pernicious nature of this campaign, there are one or two handicaps in front of those conducting it. Legislation would probably be necessary to force Electricity Boards to raise prices above the level at which they can keep their finances straight. Secondly, the anti-electricity party have not yet suggested how they propose to ensure that high-priced electricity is used for some purposes and low-priced for others. Thirdly, the public may want a say in the matter.

FIGURES AND FACTS

Carefully laid out figures can be used to prove almost anything—how much more efficient coal fires are than electric heaters for instance. It is only required to ignore inconvenient facts which spoil the statistical picture. In a letter to *The Times* Mr. E. W. B. Gill quotes an example of saving by the use of electricity instead of coal for heating undergraduates' rooms at Merton College, Oxford. Although many readers of *The Times* may consider this remarkable, it is in line with popular experience. For short-period heating, even with the super-efficient solid fuel stoves now so widely advertised by politicians and those who make them, coal fires are extremely wasteful.

FOUNDRY PRACTICE

In the early 1920's the electric melting furnace had already been installed in some steel foundries, notably in the United States, while about that time electric heat-treatment furnaces were also being introduced. Then came a period between the wars when the advocates of fabrication by electric arc welding threatened to close many foundries. But, notwithstanding the extension and still growing use of fabricated parts, foundries continue to be rebuilt or modernized (as mentioned in a N.E. Coast Institution of Engineers and Shipbuilders paper referred to on another page) while electric "handling" aids have become a feature of their mechanization.

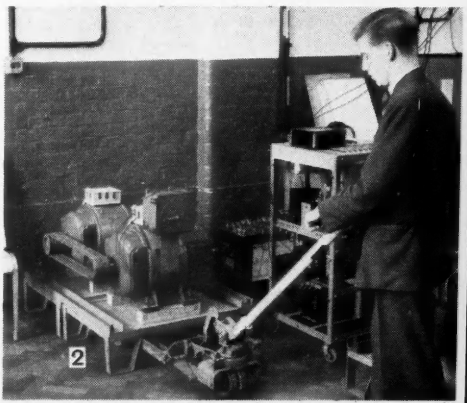
Technical College Laboratories

Improved Facilities at Wimbledon

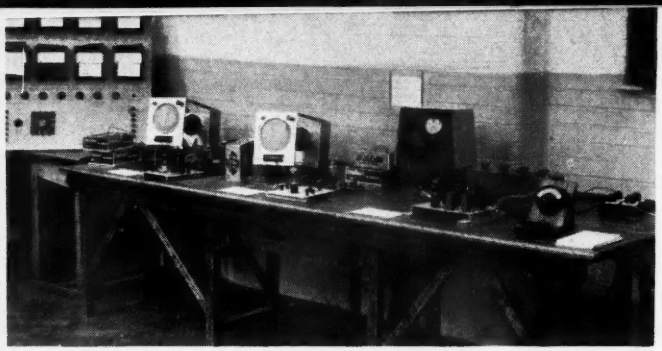
WE were recently afforded an opportunity of inspecting the work of the Wimbledon Technical College and found the electrical engineering laboratories of particular interest as they are being entirely re-equipped and re-organized in many ways on not quite conventional lines.

The College is the centre for electrical engineering education in Surrey and caters for the following types of courses for both part-time day and evening students: Ordinary National Certificate; Higher National Certificate; special courses in machines, transmission and electronics; and telecommunications and installation subjects for the City and Guilds examinations. It also offers all endorsement subjects required by the Institution of Electrical Engineers for exemption from the associate membership examination. The Department of Electrical Engineering has 268 day students who are released by their employers to attend for one day per week and 314 students who spend about three evenings a week in the College.

Quite rightly, great emphasis is laid on the practical side of electrical engineering education and this is clearly illustrated by the laboratories, some of which are as yet only partly developed. The general layout



(1) Radio transmitter and standard frequency generator equipment. (2) Illustrating the method of coupling and transporting machines. (3) General view of electrical installations workshop



Valve characteristics panel and students' oscilloscopes in industrial electronics laboratory

is somewhat unusual. At present there are four laboratories (ultimately there will be eight) which are devoted respectively to electrical machines, measurements, industrial electronics and telecommunications; there is also a workshop for electrical installation work.

Electricity Supply

The extensive programme of re-organization and re-equipment which was started in the spring of 1950 is now well under way. The main difficulties which had to be overcome were lack of space and the fact that only a single-phase supply was available. The latter problem was solved by installing a Ferraris-Arno set to feed a three-phase supply into the laboratories where the unbalance was not of great consequence. In addition to this a motor generator set is being installed which consists of a three-phase self-starting synchronous motor, supplied by the Ferraris-Arno set, driving a three-phase sine-wave generator with an output of 5 kW, constant voltage being maintained by a cross field generator. To save laboratory space these machines are housed elsewhere in the building and are remotely controlled.

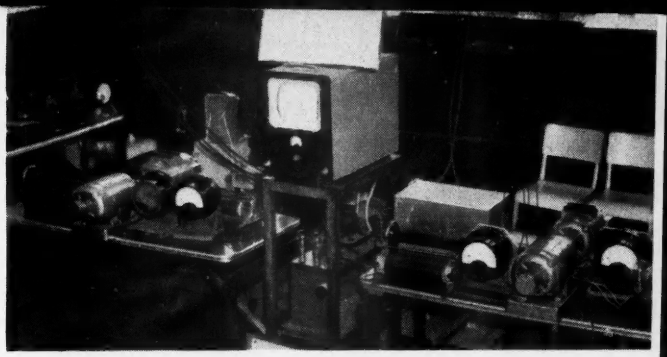
The shortage of space (about 600 sq ft only being available for the machines laboratory) was solved by arranging for all the machines to be transportable; the standard size of the machines is about 3 kW. It was decided that the maximum number of experiments which could be carried out in the machines laboratory simultaneously was five, that is, about 120 sq ft per experiment. Consequently five identical supply points have been provided, four suspended from the ceiling and one mounted on the wall. They are wired on the ring main system and comprise a 220 V three-phase point, a 230 V single-phase point supplied by a 100 A circuit breaker, a 220 V d.c. point fed by a mercury arc rectifier, a 50/250 V d.c. variable supply from a motor generator set and a 0/250 V d.c. variable supply.

All supplies are colour coded and at each single-phase supply point there is a 5 A three-pin plug socket outlet. There are no exposed terminals as they are all fitted in switch-fuse boxes from which the fuses have been removed and thus when the students make their connections the supply is isolated. Individual circuit breakers for each supply were tried but not found necessary. The complete installation, involving the use of about three miles of cable, was carried out entirely by the Department of Electrical Engineering's laboratory staff.

All machines have a double shaft extension and are mounted on bases in such a way that any two machines can be coupled. The coupling is done by two U-channels and the power is transmitted from one machine to the other by means of a multiple vee belt drive. The other end of the shaft is fitted with a brake drum on to which a portable band brake can be fitted. The machines are not stored in the laboratories but are brought in as required by means of a Slingsby truck.

Constructional Tuition

It is envisaged that all students will carry out identical experiments simultaneously but up to now this has been achieved only in the S1, S2 and S3 years and in part of the fourth year. The students use loose cores and build up transformers by means of coils of different numbers of turns of which they have measured the resistance and inductance in previous years. They practise three-phase connections with these coils but at the same time a sufficient number of commercial transformers are available for other tests. In particular there are two Foster three-phase transformers on which any type of connection can be made. Apart from tertiary windings these transformers are



Motor-alternator sets and associated equipment for synchronizing demonstrations

fitted with thermo-couples embedded in the iron and windings. Other equipment in the machines laboratory includes a Hewittic portable six-phase grid controlled mercury arc rectifier with only the starting gear incorporated. This enables students to carry out all tests by using familiar equipment, including inversion. Two variable speed a.c. commutator motors are also available, one of the Schrage type (B.T.H.) and one with fixed brushes and double induction regulator, made by Crompton Parkinson, as an experimental machine. Sufficient instruments of high grade quality are provided to enable five groups of students to carry out machine tests simultaneously. On the occasion of our visit we gathered that many students use the facilities which this laboratory offers in their own time outside teaching hours.

In the measurements laboratory students carry out bench tests although they could be carried out with equal facility in the machines laboratory if no machine tests were prepared. The Department possesses a Tinsley standard dynamometer wattmeter of the reflecting mirror type and several substandard ammeters, voltmeters and wattmeters. There are also two small motor generator sets for use as lecture demonstration models.

In the telecommunications laboratory specially designed desks ensure that not more than two students work on the same experiment. Each bench has its own electrical supplies which include 220 V, 110 V and 2–12 V a.c. and d.c. together with aerial, earth and frequency standards of 400 c/s, 1 kc/s and 1 Mc/s. These

Part of measurements laboratory

standard frequencies are obtained from ex-B.B.C. transmitter drive equipment which is accurate to at least one part in a million.

One of the main features of this laboratory is that apart from the usual commercial testing apparatus, some of which is of high grade accuracy, a great variety of college-built apparatus is available. This is made up from Government surplus stock and includes, besides a transmitter, several receivers and a large number of " breadboards " for various circuits.

The laboratory for industrial electronics is being equipped partly by an electronic construction class. Here again Government surplus material is used to a great extent for construction. There are ten students' 6in oscilloscopes in which only the essential power supplies are incorporated, external boards being used for the time base and so on. There is a demonstration board for valve characteristics which has eight 6in instruments incorporated so that the class can see the demonstration from any part of the room.

Apart from the students' oscilloscopes the Department possesses one Cossor double beam, one Taylor and one E.M.I. oscilloscope and a 9in double beam instrument which has been specially designed for demonstration purposes. On this oscilloscope provision is made for showing voltages and currents directly and measuring peak-to-peak values.

The installation workshop is in a hut just outside the main building and it is estimated that it will take another two years to complete. At present there are five specially made benches which are designed in such a way that each accommodates twenty wiring boards in racks with sufficient space left between them to enable the student to leave his partly finished work on the board until his next practical period. Every installation student has one board which he keeps for the whole year and each teacher in charge of a class is responsible for one table. The maximum number of students per class is thus limited to twenty. Provision is made for locking the boards so that no one can take them out without the teacher's knowledge.

An important activity of the Department is the Electrical Engineering Society, the object of which is to hold talks, discussions and film demonstrations, etc., in an informal manner. Acknowledgment is due to the Principal, Mr. T. S. Harker, for permission to publish this article and to Mr. T. Siklos, Head of the Electrical Engineering Department, for his assistance in its compilation.

Specially designed test benches in telecommunications laboratory

Retiring Age and Economics

Another Point of View

By E. SYKES

IN his article on this subject in your 15th February issue Mr. J. N. Waite suggested that the age of retirement should be raised. He said that all superannuation funds were insolvent because the increased length of life meant that there were more retired people and pensions were increased by the higher salaries. This article will attempt to show that there are better ways of getting over the difficulty than by raising the age of retirement.

It is true that the average expectation of life is increasing; it was rising long before our pension schemes were started and the statistics on the subject are published for anyone to see. The people who arrange superannuation schemes make use of these statistics, to a limited extent. They base their calculations on the average length of life at the time the scheme was launched. They should go one step further. They should notice, from the statistics, that the age at death is increasing all the time, so superannuation schemes should be calculated on a continually increasing length of life. That would make superannuation funds a little less insolvent.

Superannuation Scheme Contributions

The old superannuation schemes were based on a contribution of 10 per cent of salary (5 per cent from employee, 5 per cent from employer) and new schemes are being based on 15 per cent of salary, to allow for extra length of life. The new schemes will also be insolvent in due course, for exactly the same reason: that a fixed rate of contribution will fail to keep pace with the increasing numbers of those receiving pensions. It could be arranged for the rate of contribution to increase year by year, say 15 per cent this year, 16 per cent in five years time, 17 per cent in ten years time, and so on. This need not represent an increasing burden on those below retiring age, for reasons which will be explained later.

The other cause of pension fund insolvency is the rise in pensions caused by the rise in salaries. This also could have been foreseen; there are sufficient statistics of wage rates to illustrate the trend. Wages sometimes go up and sometimes go down, but the main trend for the last hundred years has been decidedly up. When the young men of to-day reach retiring age, salaries, and therefore pensions, will be very much higher than they are now and the new pension schemes will be insolvent then, just as the old schemes are now. What can we do about it?

Payments and Production

Mr. Waite is correct in saying that whatever the rates of pension, or the rates of superannuation contribution, or the amount of subsidy from taxation, etc., may be, fundamentally the financial burden of pensions is borne entirely by the production of those who are working. He is correct in saying that if we want to preserve the present standard of pensions for an increased number of pensioners, we must produce more goods, but he is wrong in concluding from this that we must work harder, or longer hours, or, in particular, longer years. There are better ways than that.

Consider the amounts involved. If we increase the working week from 40 hours to 48 hours, the amount of increased production would be 20 per cent. If we increase the retiring age from 65 years to 70 years, the extra production would be 10 per cent; or retiring at 75 years, the increase would be 20 per cent.

By comparison we can *easily* double production per man by using better methods of working. The *Manchester Guardian* "Review of Industry," January, 1952, issue, in a report on foundries on page 10, says:

> "In several cases, new equipment now allows a small team to turn out from thirty to fifty times as many castings in an hour as they did a few years ago."

That is an increase of 3,000 to 5,000 per cent. By comparison, the 10 per cent which the ironfounders could have achieved by asking the 70-year-old foundrymen

to go back to work is quite insignificant. The foundrymen, by their thirtyfold increase in production, are able to support 30 times as many dependants as before, and that is how we should support our increased numbers of pensioners.

It can easily be done. One of the more obvious methods is to increase the scale of operations, which in the expanding electricity supply industry is almost an automatic process, so that we are already using that particular method, to some extent, without being aware of it.

Labour Efficiency

Consider a simple example. There are many turbine drivers to-day who look after 10 MW turbo-generators. There are a few, very few, who operate 100 MW sets. Those few who drive the 100 MW turbines do not work any harder than the others and yet they achieve ten times as much production and they could therefore support ten times as many pensioners, if it were so arranged. The 100 MW generators were not installed for that reason, however; they were chosen because large machines have a higher thermal efficiency. The industry is well aware of the importance of thermal efficiency, but is not yet alive to labour efficiency.

This method of increasing production per man may seem obvious, but the numerous exhortations to harder work, longer hours, even longer years, and the scarcity of 100 MW generators indicates that it is not so obvious. In addition there are many less obvious methods of increasing productivity.

Now how could increased production per man be translated into better pensions for more pensioners? At present it does not have that effect. It works out like this: the 100 MW turbine driver receives almost the same wage as the 10 MW driver. He therefore contributes about the same to the superannuation fund and the fund does not directly benefit from his increased productivity. All the benefit is retained by the British Electricity Authority and eventually most of it is passed on to the consumers. It is then noticed that the superannuation fund is insolvent and the fund is subsidized by the Authority. Thus the fund receives indirectly what it should have had in any case. In the indirect form it is called a subsidy, and a subsidy is an undesirable thing, so we start talking about raising the age of retirement to reduce the numbers of retired turbine drivers, in spite of the turbine drivers' ability to support ten times as many pensioners by a tenfold increase in production per man.

Thus it is seen that increased production per man which we need is only the first step, which does not result in better pensions for more pensioners, unless we arrange it so. It can be arranged by giving the pension fund a financial share in the benefits of increased production, as a right, not as a subsidy.

There is plenty of room for improvement in the production per man, per clerk, per engineer, by the use of better methods. It could be increased considerably. Then we could talk about retiring at an *earlier* age.

News from Australia

By Our Australian Correspondent

ELECTRIC power generators under construction in Australia will more than double the present generating capacity of 2,250,000 kW, says the Minister for National Development (Senator Spooner). He adds that these projects will be progressively increased during the coming five years, and in addition a further 1,300,000 kW is planned.

The Commonwealth Statistician reveals that there are 129 factories in Australia manufacturing radio apparatus (68 in New South Wales, 22 in Victoria, 15 in South Australia, 12 in Queensland and 12 in Western Australia). Persons employed numbered 9,283 and salaries and wages paid during the year totalled £3,745,000. Total value of output was £11,762,000, representing a value added in course of manufacture of £5,252,000. The value of land and buildings was £1,204,813, while plant and machinery was worth £770,185.

Production included 8,755 domestic receiving sets without cabinets, £130,787; 334,568 sets with cabinets, £6,056,257; 75,865 wooden cabinets, £618,569; 208,697 plastic cabinets, £137,050; parts, £1,464,572; transmitting apparatus, £844,061; other radio and amplifying apparatus, £728,386; transformers and convertors, £641,485; telegraph and telephone apparatus, £3,169,213; regulating, starting and controlling apparatus, £3,348,635; and intercommunication systems, £68,603.

The City Electric Light Co., Ltd., Brisbane, is issuing a cash and conversion loan of £600,000 bearing 4¼ per cent interest. Proceeds will be used to meet the rapidly increasing demand for electricity supplies in the south-eastern part of the State.

Cartridge-Type Immersion Heaters

By D. L. LEWIS, B.Sc.*

Withdrawable Mineral-Insulated Elements

THOSE with practical experience of electric immersion heaters are well aware that their design is by no means as simple and straightforward as it may appear superficially. Conditions of use must be considered if a dependable heater is to be produced. Although the initial circumstances may be such that the element will function at a satisfactory temperature and give an acceptable performance, use in hard water districts where the accumulation of fur causes considerable increases in heater temperatures may lead to eventual failure.

Fur is a bad conductor of heat and by impeding the outward flow of energy from the element wire can cause failures if adequate margins of safety have not been allowed. A further point to be considered in the case of withdrawable elements is the size of the gap between the heater and the inside of the tube in which it lies. This space must be kept to the minimum for effective dissipation of the heat developed by the element.

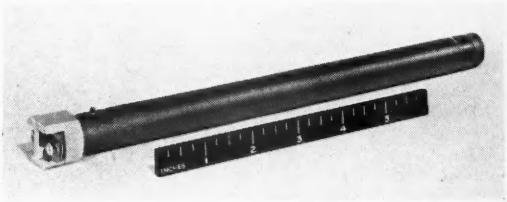
In addition the construction of the immersion heater and the choice of electrical insulating material should be such that a low thermal resistance between the heater wire and the outer tube is obtained, together with a high electrical resistance.

These considerations and the need to minimize manufacturing costs led to the development at the General Electric Co.'s research laboratories of a withdrawable cartridge element† designed primarily for use in modern water heating equipment. A new method of construction has resulted in a robust article suitable for large-scale production.

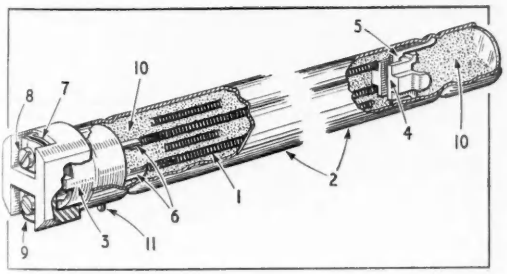
Withdrawable elements of 1½in and 2in diameter with loadings from 500 W upward and also a range of sheathed wire type immersers with loadings from 500 W to 5,000 W are already available and the use of banks of them enables any desired loading to be obtained. Such banks, however, require a relatively large apparatus plate, which is not always desirable; hence the introduction of a new type of

* Research Laboratories, General Electric Co., Ltd., Wembley, England.

† British patent No. 620,499.



Above: **Fig. 1.—New cartridge-type immersion heater, designed primarily for water heating equipment**



Left: **Fig. 2.—Section diagram showing principal details of construction:—**

(1) Coil, (2) tube, (3) lower portion of terminal block, (4) insulating saddle, (5) metal stirrup, (6) end leads, (7) terminal plates, (8) nickel-plated brass screws, (9) contact washers, (10) insulating material, (11) bayonet peg

element which fits into a ¾in pocket tube. It is now being produced in loadings of 500–1,500 W and lengths from 10 to 15in, from which it will be seen that the reduced diameter has not been obtained at the expense of increased length.

The method of construction used can be applied to larger diameter heaters and one such element of a nominal diameter of 1in is being developed. It is anticipated that for water heating equipment loadings of up to 3 kW may thus be accommodated in a length of about 20in.

All the points mentioned have been taken into consideration in the design of the new immersion heater (Fig. 1) and due allowance has also been made for service conditions. The nickel-chrome heater wire is wound (Fig. 2) as a helical coil (1) which runs from the lower portion of the terminal block (3) along one side of the tube (2) to the closed end. There it passes over an insulating saddle (4) supported on a metal stirrup (5) and returns on the other side of the tube to the terminal block. One or two coils may be used, depending on the loading required. When two coils are incorporated in the heater they cross one another on the insulating saddle, which is designed so that the coils are insulated from each other. The ends of the coils are electrically welded to the strip end leads (6).

The coil terminations of any heater must be mechanically strong, securely fixed and electrically sound; these requirements are all met by the welding method employed. The end leads pass through slots in the terminal block and have terminal plates (7) electrically welded to their ends. These plates are plunged and tapped to take 4BA nickel-plated brass screws (8) which secure contact washers (9). The heater is filled with powdered magnesia (10) which is compacted during manufacture to ensure good conduction of heat from the coils to the outside of the heater. The coils are so designed and the particle size of the refractory insulation controlled to ensure that the interstices between the coils are filled with powder during the filling operation.

The insulating material is consolidated during manufacture by a reduction in diameter. Brazed to the heater at the terminal end is a bayonet peg (11) which fits in a bayonet slot in the pocket tube. The heater is designed to be mounted in its pocket tube in either a horizontal or vertical position and is held in place by the bayonet peg.

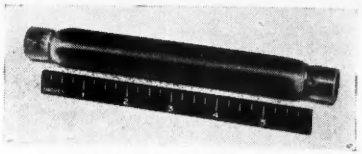
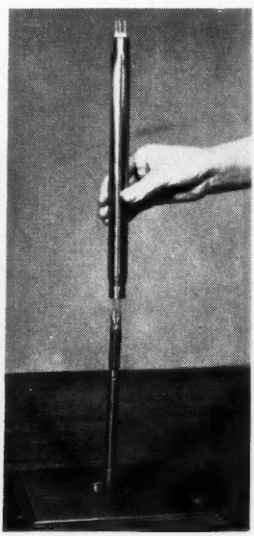


Fig. 3.—Tube ready for assembly of coils

The diameter of the element after reduction is about 0·74in, giving a suitable clearance in a 0·75in inside diameter tube. The dimensions of this gap are such that effective conduction of heat from the brass sheath of the heater to the metal wall of the pocket tube is obtained. During manufacture sizes are controlled to permit easy insertion of the element into the pocket tube and, if necessary, subsequent withdrawal during use.

The stirrup carrying the insulating saddle at one end of the tube and terminal block at the other end are positioned with respect to the tube and hence with respect to one another by indentations pressed into

Figs. 4 and 5.—Two stages in the operation by which coil sub-assembly is mounted in tube



the ends of the tube. A single indentation at one end of the tube engages in a groove in the terminal block and prevents it twisting, while the two indentations at the other end of the tube prevent the stirrup from twisting and orientate it correctly with respect to the terminal block.

The tubes, cut to length, are fully annealed in a box furnace with automatic control which raises the temperature to 650 deg C and maintains it for the required heat soaking period before switching off ready for the next load. The ends of the tubes are then swaged and indented and appear at this stage as shown in Fig. 3.

The element coils are wound with first grade nickel-chrome wire on a steel mandrel rotating at 5,000 r.p.m.; the ends of the coils are electrically welded to the end leads by a method which makes a mechanically and electrically sound joint and also allows simple visual inspection of the weld itself to ensure the maintenance of a high standard of quality at this important point.

Fig. 6.—Drawing down assembled and filled tube to final diameter (guard doors open to show hydraulic head)

The coils and the end leads are assembled in the terminal block, ready for mounting in the tube, which operation is carried out by means of a simple assembly jig; two stages are shown in Figs. 4 and 5. A specially designed machine fills the tubes with the powdered insulating material. After the insertion of a disc in the end of the filled tube a vertical hydraulic drawbench is used to draw down the tube to its final diameter and so compact the refractory powder. This drawbench (Fig. 6) has safety gates linked with the operating handle. Next the drawn heaters receive a normalizing heat treatment, after which the loading at the rated voltage is checked to ensure compliance with the manufacturing tolerances specified in B.S. 1,556.

The upper portion of the terminal block (see Fig. 2) is now added and the bayonet peg brazed in position. The terminal plates are welded to the end leads and to the assembly are finally added the contact washers which are marked with the voltage and loading of the heater.

Satisfactory performance has been obtained with these heaters, both in service and in laboratory life tests. During life tests they have operated under overload conditions for tens of thousands of hours without failure, in both vertical and horizontal positions. An interesting feature is the nature of the fur deposit on the pocket tube in hard water districts. It builds up to a certain thickness and then flakes off, as the result of differential expansion caused by the "on" and "off" cycles of the controlling thermostat.

Satisfactory wire temperatures have been measured under actual running conditions, which shows the soundness of the basic design. Measurement of leakage current between the coils and the sheathed outer case indicates that it is less than 0·5 mA when the heater is operating at 20 per cent overload.

While intended primarily for use in water heating equipment, this type of element lends itself to other uses where a withdrawable cartridge element with the

connections at one end has advantages. It has been applied as the heat source in absorption type refrigerators and has been successfully used for this purpose.

Another engineering application is to the tightening of large bolts used on the horizontal flanges of steam turbine casings. The bolts are expanded *in situ* by a highly loaded heater inserted in a central hole drilled down the axis of the bolt. The heater is switched off and removed when the bolt has become sufficiently hot to allow rotation of the nut through a predetermined angle, dependent on the resultant stress required in the shank of the bolt. For the above application the brass sheath used on immersion heaters for water is replaced by a heat-resisting steel sheath.

Steel Conduit Joints

Incidence and Avoidance of High Resistance in Service

ASSUMING normal methods of protection against danger from earth leakage, the safety and security of a wiring installation enclosed in steel conduit depends greatly on the maintenance of a low resistance along each run of conduit throughout its life. The resistance is governed by the resistances of a number of joints, some initially tight and some initially slack, but all presumably subject to ageing which may result in deterioration.

In E.R.A. Technical Report V/T 109* are recorded the results of a survey of the resistance measured in service of typical conduit runs in three factories, a laboratory and one municipal building, 85 runs in all having been covered. They varied between 5 and 80ft in length, the number of joints in a run ranging from two to 45. It should be noted that the average fitting or coupling has two joints. The most frequent number of joints in a run was between five and ten, over all installations; for factories alone the number was between ten and fifteen. One of the factory installations investigated was of the pin-grip type; the remainder were of the screwed steel conduit type.

Of the 83 runs to which the data in the report relate more than 40 contained at least one joint which was unsound. Two cases only were encountered in which deterioration of continuity was likely to have been due to the rusting of an initially well-made joint. Both these cases were in moist or otherwise corrosive atmospheres in a wash-house.

The report makes recommendations for improving the performance of conduit joints as well as for measuring and specifying permissible limits of the resistance of runs. The general conclusions arrived at from these extended tests confirmed earlier investigations (Reports F/T 152 and F/T 157) and may be summarized as follows:—The resistance of properly tightened joints in screwed and lug-grip conduit remains low in adverse circumstances; for clearance-hole joints the performance of a male bush and coupler is superior to that of a female type, the use of a brass compression washer being unnecessary with the former; the greatest potential danger lies in those joints which are not completely tightened during assembly; in screwed conduit systems there will inherently be some slackness of joints unless at least one locknut is used on each section of conduit; in identical runs with the same proportion of slack joints in each the grip type is more likely to develop high resistance than the screw type. The importance of a high standard of assembly is thus again emphasized, particularly with respect to grip conduit installations.

The survey revealed that a relatively small number of runs, less than 10 per cent, had an overall resistance greater than 1 ohm. For the length of run and numbers of joints covered by this survey runs with more than 80 to 100 mΩ resistance (at 1 A d.c.) could be considered as having one or more improperly tightened joints; about half the number of runs examined fell within this group. The resistance of a

* British Electrical and Allied Industries Research Association, Thorncroft Manor, Dorking Road, Leatherhead, Surrey, price 12s.

slack joint when new is greatly dependent on the constraint at the joint. Slight bending moments or shearing forces reduce the resistance to a value which is not significantly different from that of a tight joint and does not vary significantly with current over the range tested (1 to 25 A). New screwed conduit runs installed by a reputable firm which had on installation a resistance of the order to be expected if all joints were sound subsequently developed resistances which were indicative of unsound joints.

No measurement of resistance at a specified current can detect all joints which are likely to become unsound. There is a likelihood that measurements at two or three current values might be a more sure criterion. Most joints of high resistance probably become so by corrosion, despite constraint at the joints. Therefore the use of a protective and conductive compound in the joint would eliminate a large number of high resistance joints. Such protective compound in a tight joint usually increases its resistance but the increase is not important (for any of the compounds tested) and there is no important adverse effect on the service life of the joint. Such protective compounds should not have a yield point, or a low one, at normal temperatures so that flow is possible under the smallest forces.

Of all the protective media tested "atomized lead" (proprietary) gave the best results. It seemed probable, however, that the consistency and setting properties of this compound were the important factors rather than conduction through the material. Commonly employed protective materials mixed with an appropriate vehicle of such a consistency that they just flow would probably give similar results.

The report recommends that grip conduit should be avoided in outdoor installations. It is advisable to use at least one locknut on each section of screwed conduit, or to apply protective compound to the threads of each joint. The permissible limit to the resistance of the earth continuity conductor should be reduced to 0·1 ohm for *newly installed* systems except for runs known to exceed 100ft in length. Continuity tests should be required to be made with a range of currents. Undue variation of the values of apparent resistance measured in this way should be assumed to denote non-compliance with the I.E.E. Regulations for the Electrical Equipment of Buildings.

Humidifiers for Aircraft

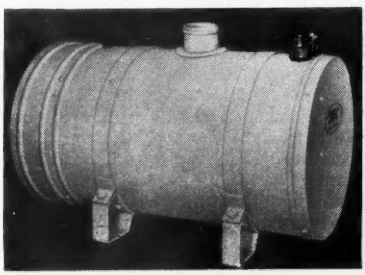
TWENTY humidifying units are being supplied by the General Electric Co., Ltd., for installation in Bristol "175" aircraft. Steam from the electrically heated boiler is fed into the cabin air supply through a 2in pipe while water is pumped into the boiler through a float chamber which automatically maintains the correct water level by actuating a micro-gap switch in the feed pump circuit.

If a failure in the feed causes the water level in the float chamber to fall, a second micro-gap switch cuts out the heating elements. The unit is intended to be controlled by a humidistat so as to come into operation when the relative humidity falls to 25 per cent and to cut out when it rises to 60 or 70 per cent.

The 1½ gallon boiler has 10 pocket tubes, mounted in a removable apparatus plate, each of which accommodates a 750 W cartridge type element. By varying the number of heating elements any desired loading up to 7·5 kW may be arranged and by increasing the overall length of the unit slightly the total loading may be increased to 10 kW. Heaters for several voltages ranging from 112 V to 250 V a.c. or d.c. can be accommodated. The steam generated by the 7·5 kW unit is about 19·5 lb/hr while the 10 kW model produces about 26 lb/hr.

The complete unit weighs 32 lb and its overall dimensions are 18¾in long by 10¾in high to the top of the steam pipe.

Humidifying unit for use in Bristol "175"



GLASGOW TRANSPORT

Manager Criticizes Inglis Report

IN a recent report to members of the Transport Committee, Mr. E. R. L. Fitzpayne, M.I.E.E., M.I.Mech.E., general manager of the Glasgow Corporation Transport Department, strongly criticizes the Inglis Committee's proposals for Glasgow passenger transport. He expresses disagreement with the form of integrated railroad and municipal transport proposed, and suggests that the Committee, consisting as it did of five railway men and an Edinburgh bus operator, was neither impartial nor competent to solve the Glasgow transport problem. It would have been courteous, he suggests, if a number of Glasgow Corporation representatives had been appended to the Committee by the British Transport Commission.

Dealing with the proposal that tramways throughout the city should be gradually replaced by trolley-buses or motor-buses, Mr. Fitzpayne quotes the following paragraph in the Report:—" It behoves us to be careful not to cast away a high-capacity means of transport until we can substitute some other means of equal capacity without some of the disadvantages of the tramway." He then points out that in his own report in 1948, which was based on the Bruce Plan, proposals were made for the introduction of electric railed vehicles on their own reserved tracks. Such proposals would, he still considers, provide a superior service to the Inglis proposals of " simply electrifying existing railways."

Valuable Asset

" In the meantime, for better or worse," he says, " we possess in the tramways a very valuable asset, and the Transport Committee will be well advised to maintain this tramway system to as high a standard as possible and to consider conversions, as they have done recently, when the need arises."

He points out that no mention is made in the Inglis Report of the very heavy expenditure which would fall on the Corporation if (as proposed by the Inglis Committee) the tramway services outside the city boundary were abandoned, or of the still greater expense of virtually abandoning the tramway services in the city. If the tramway lines, measured as single track (185 miles in the city and 81 miles in the outside burghs and counties), were abandoned, it would cost Glasgow £2,000,000 to reinstate the roadways.

A reverse argument from that of the Inglis Report could be easily built up—that tramways should be used to an even greater extent than at present, instead of being eliminated. This is because the tramway section is largely debt-free. It could be argued that it would be a much more economic proposition to spend the £2,000,000 in renewing some of the assets of the tramway section and obtain a revenue return for the expenditure.

Speed Comparison

The Report classes the tramways as the slowest passenger vehicle. In fact, the modern Corporation tram has a higher acceleration than a double-deck bus and can easily attain a speed of 30 m.p.h. It should be obvious that if buses took over the city traffic instead of trams, their speed would be much lower than 11 m.p.h.

Mr. Fitzpayne refutes the statement that trams are more expensive to maintain and operate than buses, and to prove his point quotes from the published returns for the year ended 31st May, 1951, which show that whereas in the case of trams the proportion of operating expenses and fixed charges to total revenue equalled 106·2 per cent, in the case of buses the figure was 114·9 per cent. The most expensive section of the Department, he says, is the electrified Underground, and even that had a surplus of £2,125 in 1951—a surplus which would not have existed if it had been possible to scrap the Underground and replace it by buses.

In commenting generally upon electric transport, Mr. Fitzpayne observes that if one is critical of some of the recommendations, it should not blind one to the merits of railway electrification. He notes that he had envisaged the development of the existing Glasgow Underground, " which has been such a success in recent years," and suggests that some thought should have been given to its future use.

VIEWS on the NEWS

By REFLECTOR

A CASABIANCA-LIKE spirit has been shown by the inhabitants of Tignes, a village on the Isère which Electricité de France is about to submerge in a hydro-electric reservoir. Although the electricity supply authority has built a new village church, vicarage and hall and given generous compensation for the building of new houses the villagers have held out. They claim that they should have had more notice but the scheme was started four years ago. The latest news suggests that, after all, they are not going to stay until the water closes over their heads. As the scheme is designed to benefit a large section of the French population their sacrifice (if such it can be called) will not have been in vain and they will probably be better housed.

* * *

Although the provision of guards on electric and gas fires is intended principally for the protection of children and old people, those in between often need protection too. For instance Mr. Nabarro, who introduced the Heating Appliances (Fireguards) Bill, mentioned that he himself had had the tail of his coat burned while standing with his back to an unguarded fire. By this means, no doubt, he proved the necessity of his measure as well as the virtue of the closed solid-fuel fire of which he is an advocate.

* * *

There is a growing tendency to overdo the use of certain words and misuse many of them. I have for a long time been irritated by "target," "short supply," "contact" (as a verb), etc. Now "deploy" appears to be a favourite. Men can be deployed and so, I suppose, can materials. In the House of Commons last week, however, the Minister of Fuel and Power told a member that he would take steps to secure the strategical deployment of all new power stations projected by the B.E.A. Siting is a shorter and probably more exact word. By the way, strategy seems to add another awkward factor to the already difficult problem of finding suitable sites for power stations.

* * *

I have made previous references to the floodlighting of football grounds for evening matches. These related to what were in the nature of experiments but now the business seems to be getting on to a firm basis. There are reports that a "Floodlight Football League" is to be formed and I see that one of the teams concerned is the Revo Sports Club. If this movement results in the substitution of evening games for the mid-week matches, which now lead to a great loss of working time, it is to be welcomed—apart from the valuable off-peak load likely to be provided.

* * *

A correspondent of the Wolverhampton *Express and Star* says he was surprised to see a florist's van outside the "luxurious" new showrooms of the Midlands Electricity Board in Dudley and a profusion of flowers being taken inside. He says that it has happened on the last two Mondays and he objects to this expense. Alderman W. S. Lewis, chairman of the Board, however, believes in "saying it with flowers" and says that they expect their showrooms to be as bright as those of any other business concern. Only a curmudgeon would disagree.

* * *

King Claudius in *Hamlet* remarks that "diseases desperate grown by desperate appliance are relieved." Recently a worker at the Stockport power station told a Court that he had received a shock in the course of his work. He said, as reported by the *Daily Express*, "it sent up fire and smoke and burned my glasses off, but it cured my rheumatoid arthritis." Such an "appliance" is a little too desperate I think.

PERSONAL and SOCIAL

News of Men and Women of the Industry

LAST week the Belfast Corporation Electricity Committee decided to advertise the position of city electrical engineer which will become vacant by the retirement of **Mr. W. J. Girvan** in September. A salary scale of £2,300 rising to £2,750 is to be offered, the starting point depending upon the successful applicant's qualifications.

Dr. P. E. Hammarlund, chief design engineer Asea Electric, Ltd., and the Fuller Electrical & Manufacturing Co., Ltd., will be leaving the service of these companies on 31st March to take up a senior position with A. S. E. A. in Sweden. He will be succeeded by **Mr. A. J. Haselfoot,** who, for the last five years, has been manager of the power department of Asea Electric, Ltd. After taking a first-class honours degree in engineering at Oxford, Mr. Haselfoot obtained his early training with the B.T.H. Company and with Merz & McLellan. Before joining Asea Electric, Ltd., he spent thirteen years with the S.E.E. District of the Central Electricity Board, becoming chief assistant in the Technical Department and, later, chief assistant in the Operations Department.

Mr. A. J. Haselfoot

Lt. Cdr. (L) W. R. Hayward, R.N.V.R., who joined Venner, Ltd., in February, sails for New York on 1st April in the *Queen Elizabeth* to visit American associates in New York and thence to Canada where he will join, as sales manager, the executive staff of the newly formed company, Silvercel of Canada, Ltd. Commander Hayward has left Admiralty service to take up the Silvercel appointment.

At a meeting of the Midlands Electricity Consultative Council on 17th March the chairman, **Alderman H. Leason,** was presented with a vacuum cleaner, subscribed for by the members of the Council and its local committees, upon the occasion of his marriage.

Mr. W. A. Renaut, F.I.A.C., has been appointed head of the General Accounting Dept. of the British Thomson-Houston Co., Ltd., Rugby, with effect from 1st March. He succeeds **Mr. H. E. Roberts,** who retired at the end of February after forty-one years' service with the company. Mr. Renaut joined the General Accounting Department of the B.T.H. Co. thirty-two years ago and from 1934 until March this year he was personal assistant to the comptroller.

Mr. D. MacL. Smith, chief engineer of the Gas Turbine Department of the Metropolitan-Vickers Electrical Co., Ltd., has been elected a Fellow of the Royal Society.

Mr. A. E. Flatman, general works manager, and **Mr. J. E. Geis,** manager MS gear, of Arrow Electric Switches, Ltd., are flying to the United States on 30th March to study the latest manufacturing methods and other technical problems relating to motor control gear in Arrow's parent company's factory in Hartford.

Mr. J. S. Exley, formerly publicity manager of Richard Sutcliffe, Ltd., has been appointed Continental representative. **Mr. V. Quaintrell** has been appointed to the position of chief buyer and **Mr. P. Woodward** becomes publicity manager.

Mr. C. S. Dingley of British Industrial Plastics, Ltd., has been elected chairman of the British Plastics Federation, and **Mr. A. E. Skan,** a director of the Ellison group of companies, including George Ellison, Ltd., Tufnol, Ltd., and Alfred Ellison, Ltd., has been elected vice-chairman.

Mr. F. H. Pilcher, who joined W. T. Henley's Telegraph Works Co., Ltd., in England in 1912, and has served in India and Pakistan since 1924, retired from his position of manager for that territory on 19th March.

Mr. F. H. Pilcher

Mr. F. Moore

having reached the company's age limit, and is returning to this country.

He is succeeded by **Mr. F. Moore,** formerly manager of the Bombay branch. Mr. Moore has had a long and varied experience of the company's affairs in India.

London Transport announces that **Mr. A. V. Manser,** B.Sc., A.M.I.Mech.E., A.M.Inst.C.E., assistant mechanical engineer (works - railways), has been appointed chief mechanical engineer (railways).

Dr. **G. N. Patchett,** senior lecturer in the Electrical Engineering Department of Bradford Technical College, has been recommended as the new head of the department. Before being apprenticed in the Bradford Corporation Electricity Department, Dr. Patchett was a student at the college from 1934 to 1937. At the beginning of the war he trained army and R.A.F. men at the college, and after the war he became a lecturer in the Electrical Engineering Department.

Miss M. G. Gosse has resigned from the chairmanship of the Association of Electrical Housecraft Advisers and has been succeeded by **Miss M. Mitchell,** the London Electricity Board's senior demonstrator at St. Pancras.

At the twenty-third annual dinner of the **Electrical Power Engineers' Association (Kent Section),** held at the Royal Star Hotel, Maidstone, on 22nd March, Mr. H. F. Knell, J.P., M.I.E.E., manager, Kent Sub-Area, South Eastern Electricity Board, proposed "The Association" and the national president, Mr. G. L. Moss, A.M.I.E.E., responded. Mr. A. G. Salter (chairman of the Kent Section), presided, and welcomed the ladies and other guests.

The newly-formed Amateur Dramatic Society of **Erskine, Heap & Co., Ltd.,** recently staged the three-act farce **"See How They Run"** by Philip King. The farce ran for three nights, and its enthusiastic reception was highly encouraging for this Society's first show. The acting strength is upwards of twenty members at present.

Elliott Brothers (London), Ltd., announce that **Mr. W. P. Rowley,** M.B.E., M.Brit.I.R.E., has been appointed sales manager of the Electronics Division of the Elliott organization. He will be responsible for the sale of Elliott magnetic amplifiers and electronic apparatus. Mr. Rowley was formerly with the Edison Swan Electric Co., Ltd.

A dance was held by **Falk, Stadelmann & Co., Ltd.,** at the North Victoria Hall, Bloomsbury, W.C., on 14th March. Several hundred people were present and dancing continued until 11.30 p.m. Prizes were presented to the lucky guests by Mrs. Hugo Falk, the wife of the managing director. The dance was organized by the Committee of the Veritas-Efesca Social Club.

OBITUARY

Mr. Christopher Skinner, a director of Gent & Co., Ltd., died on 6th March at the age of eighty-four. Mr. Skinner joined the company in 1900 and was for many years well-known throughout the trade as the sales representative for the Midlands area and subsequently as sales director. He relinquished this position some years ago but retained a seat on the board. His son, Mr. Harold Skinner, is manager of the company's Newcastle branch.

Mr. W. M. Armstrong.—The death occurred on 21st March, in a Surrey nursing home, at the age of seventy-two of Mr. William Martin Armstrong, A.M.I.E.E., late of Heaton, Newcastle-on-Tyne.

WILLS

Mr. F. Fraser, F.C.I.S., a former secretary and director of the British Thomson-Houston Co., Ltd., and director of Ferguson, Pailin, Ltd., and other electrical companies, who died on 21st November last, left personal estate in England and Scotland valued at £48,773.

Mr. C. T. S. Arnett, late controller of the North Western Division of the British Electricity Authority, who died on 4th October last, left £9,486 gross (£5,886 net).

Mr. W. L. Shand, M.I.E.E., for many years with Merz & McLellan, who died on 17th September last, left £417.

Institute of Welding

THE Institute of Welding is holding its spring meeting in Glasgow from 24th to 26th April. The whole of the first day will be taken up with two works visits for a limited party, who will inspect the Linwood factory at Paisley of the Pressed Steel Co., Ltd., in the morning and the Clydebridge, Cambuslang, works of Colvilles, Ltd., in the afternoon.

The presentation and discussion of technical papers will occupy the next two mornings. Papers to be presented are:—"The Construction of a High Speed Wind Tunnel" by J. H. Bell, "Some Changes in the Shipyard with Particular Reference to Oil Tanker Construction" by J. Rannie, "Welding in Hydro-Electric Plant" by J. Crawford, and "Light-weight Welded Construction in Mechanical Engineering Structures" by F. Koenigsberger.

On the afternoon of 25th April there will be a choice of visits to the works of Sir William Arrol & Co., Dalmarnock Iron Works, John Brown & Co., Clydebank, and Harland & Wolff. Social engagements will include a whole-day excursion for ladies and a dinner. The president of the Institute, Mr. Howard J. Thompson, will preside.

Heating Methods Discussed

Comparative Efficiency and Cost

CORRESPONDENCE continues in *The Times* on the subject of national fuel policy in which the merits and demerits of various forms of heating have been discussed. Last week Mr. V. W. Dale, general manager of the British Electrical Development Association, came forward to defend electricity. He said that Professor Simon (who had condemned electric heating) had ignored the fact that much of the heating in homes was required only occasionally and for comparatively short periods: in these circumstances the overall efficiency of the electric method was invariably far higher than that of solid fuel—apart from the fact that electricity production involved the use of coal which was useless to the householder.

Mr. Dale said that the "balanced picture" called for by Professor Simon must take into account costs of transport, refuse disposal, domestic labour, interior decorating, material destruction and atmospheric pollution which raised the need for reduction of the use of solid fuel whenever possible. He emphasized that electricity was the only real "all-purpose" agent. When atomic energy was available it would naturally be distributed in the form of electricity.

In the following issue of *The Times* the case for electric heating was put by Mr. E. W. B. Gill, who quoted an actual case from his own experience at Merton College, Oxford. He showed that by the use of electric fires instead of coal fires in undergraduates' rooms there had been an actual saving during a winter term of 9 cwt per room: even if the best modern coal stove had been used there would still have been a substantial saving.

On the same day Mr. Harold Sinclair (an industrialist) referred to the 800 kW electric boiler installed at the B.E.A. offices at East Didsbury, Manchester (see *Electrical Review*, 8th February, p. 301). He suggested that this off-peak use of electricity generated from low-grade coal would be valuable to industrial concerns if a favourable tariff was made available.

In another letter, Mr. E. Bellingham, director-general of the Coal Utilization Council, agreed that, until sufficient solid fuel appliances were obtainable, to tell people not to switch on their electric fires in cold weather is "like selling umbrellas in Manchester on condition that they are not to be put up when it rains."

Electrical Plant Contracts

Change in "Cost of Material" Index

IN connection with the B.E.A.M.A. Contract Price Adjustment Clauses the B.E.A.M.A. Council recommends that the new indices now being published monthly in the *Board of Trade Journal* shall be used, as appropriate, in place of the old Intermediate Products Index for new tenders and contracts forthwith. To provide for contracts already in progress involving the use of the old Intermediate Products Index, the latter will continue to be published until December next. The Association has made arrangements with the Board to make the necessary index numbers available so long as these figures are required for existing contracts, although the Board may no longer publish them.

The new material indices recommended by the Council for use, with the latest figures, are:—

(*a*) For tenders and contracts for electrical machinery including alternators (other than those driven by steam or gas turbines), motors, transformers, switchgear and other electrical equipment: the Price Index Numbers of Materials used in the Electrical Machinery Industry (15th March, 160·2).

(*b*) For tenders and contracts for turbo-generating and allied plant, viz:—steam or gas turbines and their turbo-alternators, condensers, feed heaters, and mechanical auxiliaries so far as these are associated with generating units and included in the same contract: the Price Index Numbers of Materials used in Mechanical Engineering Industries (15th March, 143·6); the Price Index Numbers of "Blast Furnaces and Iron and Steel Melting and Rolling (40 and 41)" (15th March, 127·1); and the price per lb for brass condenser tubes ¾in o.d. 18 s.w.g. as published in the *Metal Bulletin* (21st March, 3s 7½d).

The Intermediate Products Index figure (for use in existing contracts) published in the *Board of Trade Journal* on 15th March is 363·8. In each case the rate of pay for adult male labour at 15th March is deemed to be 134s.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

"Nationalized Inertia"

I READ, with interest, the article in your issue of 14th March, entitled "Nationalized Inertia" in which very general and sweeping criticism is made of the electricity supply industry, and the British Railways and Road Services. I am writing solely with regard to the operations of this Board.

I have no knowledge of any instance in our operations to which this criticism could fairly apply, but if your contributor will write to me, giving particulars of any specific case, I can assure him that his anonymity will be preserved and the alleged inefficiency dealt with.

Your contributor appears to have had somewhat unfortunate experiences, but I would suggest to him, with respect, that the best method of dealing with such cases is to get into touch with the appropriate Board, giving full details, for it may be that a perfectly good reason exists for an isolated instance of apparent delay.

L. HOWLES,
Chairman,
South Wales Electricity Board.

St. Mellons, Cardiff.

YOUR anonymous correspondent referred to "ordering and purchasing procedure," but inertia and frustration are by no means confined to this part of the work.

The set-up of the nationalized electricity industry encourages inefficiency and delay. There are three or four "tiers," e.g., Area Board, Sub-Area, and District. The fourth could be either a sub-district, or the London headquarters. If a District official wishes to place an order with manufacturers (other than a small "local" order) he sends six copies of the order to the Sub-Area where it is "vetted." A few weeks later, in some cases, an office lad will write or ring and inquire whether the materials on the order are really required. He may return it to the District office for re-typing if the wording of the order is not approved. The Sub-Area department ultimately forwards the order to the Area Board and I have known of orders marked "Urgent" to be still floating around the purchasing office up to six weeks later.

It should not be assumed that purchasing clerks wilfully delay these orders: what seems to happen is that various firms are approached so that the order may be placed with the one which offers the most favourable terms. Despite all this, I have known cases where it would have been cheaper and certainly much quicker to have purchased the goods locally, although the purchasing department has found it necessary to place the order with a distant firm. Referring again to delays, I can recall a very harassed official who held up scores of District orders for weeks because of pressure of other work.

The following is a typical experience of my own:—As a result of complaints that workmen were short of tools, I telephoned a reputable firm which had given good service previously and was told that the tools were in stock and could be supplied upon receipt of an official order. Six copies of the order were forwarded to Sub-Area. A month later I learned that the firm had not yet received the order. After many attempts I found from the young assistant who "vets" the orders that the order had been "approved and passed on." A few weeks later I again urged the tool firm to expedite delivery, but it protested that the order had still not been received. When the tools ultimately arrived, I telephoned my thanks to the firm, but they protested that they had not sent any tools, and still had received no order. They sent a representative, however, to inspect the tools and I had the humiliation of learning that the tools were not of their manufacture—my original order had been altered without any reference to me.

A further cause of inertia may possibly be traced to the time-wasting endless spate of departmental and other conferences, works committees, advisory committees, education and training courses, etc. (We must have been a very ignorant crowd before nationalization.) I have been obliged to waste many hours at meetings

where, so often, nothing of any value transpired after hours of talk. Large staffs are required to type and publish agenda and minutes of all the conferences, not forgetting the catering arrangements and the other expenses involved.

Where, say, two workmen were capable of installing a service cable and meter to certain domestic premises in the past, it now appears to require five workmen and additional transport. Then, of course, there are constant hold-ups when trying to telephone a nationalized industry; with so much of the work centralized in a large building, the telephone lines are usually all engaged, and nobody can find anyone, causing further delay.

It is obvious that the costs of this administratively heavy machine could be cut considerably, delays avoided, tariffs reduced, and efficiency reintroduced into the industry, but when will the reorganization begin?

" BUNKERED."

THE nail is hit right on the head by the author of this article; in fact it is so exact that I can only think it is based on experience with our Sub-Area.

The assumption that engineers' orders are mere bits of paper in headquarters clerks' baskets is also correct. For example, before our host of clerks got *their* system established in our Sub-Area, responsible engineers could place orders direct with manufacturers. We could ring up our local branch and inquire into stock positions and have the goods in our stores next day. Now we ring up our local branch, decide they have a suitable article in stock, but they cannot deliver without our official order. An internal order is passed down our " pipe line " by the engineer; if we are lucky the firm get the order in three to six weeks, and they deliver to us the day following its receipt. This also assumes that our purchasing clerks have decided that they cannot obtain a cheaper article elsewhere, irrespective of engineering advantages, etc.

The remedy is obvious: all stores should be in charge of an engineer, and nothing but the routine standard lines bought in bulk and distributed by stores headquarters. Senior engineers should be allowed to make decisions, as in the past, for after all this is what they used to be paid for. The apparent amount saved by our purchasers is lost two or three times over by clerks' salaries, paper costs, wasted time and delays in completing work.

MAINS ENGINEER.

Gas-Electric Methods

YOUR survey of the Ideal Home Exhibition emphasizes the absence of new products. Is there, however, any valid reason why the public should continue to be unable to purchase mixed gas–electric cookers as are readily obtainable in the States and on the Continent? Why should appliance makers continue to appease the gas and electricity authorities now that these are nationalized and could, or should, be considered as a single entity at the service of the public?

Putting all prejudice or interest aside, is not the best domestic cooker one which has an electric oven, an electric hotplate and grill, and a gas ring—to which might be added a " Calrod " element for a three-plate unit, and perhaps a second gas ring for a four-plate unit? Can any electric hotplate element touch a gas ring for controllability whatever control device is used?

Further, where hot water is obtained through an electrical storage cylinder, is it not advisable to have a small but powerful gas geyser feeding the kitchen sink so as to provide an immediate supply of extremely hot water? In short, it would seem that the average home is best served by having both gas and electricity for domestic appliances.

London, W.1. F. P. D. SCOTT.

Bradford Contractors' Dinner

THE annual dinner of the Bradford Branch of the Electrical Contractors' Association was held on 22nd March. Mr. T. Pitts, proposing the " City and Trade of Bradford," suggested that Electricity Boards should keep to their primary function—generation and supply—and that it was wrong for them to be dealing in wiring, plugs, radio and television at the trade's expense. Alderman Horace Hird, Lord Mayor of Bradford, responded. Mr. T. H. Carr, manager of the Yorkshire Electricity Board's Bradford Sub-Area, in proposing the toast of the Association, said that he and the electrical contractors were getting along very well together. The Branch chairman, Mr. W. Womersley, replied. Other speakers included Mr. W. Shackleton, president, Bradford Society of Architects and Surveyors, and Mr. E. B. Gosling, president, Engineering Employers' Federation, Bradford.

PARLIAMENTARY NEWS

From Our Special Reporter

REPLYING to questions in the House of Commons last week by Captain Ryder, the President of the Board of Trade (Mr. Thorneycroft) said that during 1951 individual licences for the import of refrigeration equipment from dollar sources were issued to a total value of £557,710. This figure included licences to a value of £142,413 which were issued under the Token Import Scheme. The remainder were for essential home use or re-export, individual applications having been considered on their merits. Refrigeration equipment from other sources was imported in 1951 under Open General Licence. There were a number of changes in the import licensing arrangements for 1952. First, Token Import quotas had been reduced by value from 40 per cent to 30 per cent of the pre-war figures. Secondly, applications to import from dollar sources otherwise than through the Token Import Scheme would be considered against more stringent criteria. Thirdly, so far as imports from non-dollar sources were concerned, domestic refrigerators were removed from the Open General Licence with effect from 11th March. The size of the quota had not yet been determined.

Interference Suppressors

Mr. Langford-Holt asked the Assistant Postmaster-General when it was proposed to issue an Order requiring new motor cars to be fitted with interference suppressors.

Mr. Gammans said a regulation was now in preparation. As this question was very technical the Postmaster-General proposed to refer the regulation to the Advisory Committee before laying it before the House. Most large manufacturers of cars were already fitting suppressors to new cars.

Increased Telephone Charges

Mr. W. T. Williams asked the Assistant Postmaster General what estimate he had formed of the additional revenue to be obtained by the reduction of the 100 free calls to 50.

Mr. Gammans said that the estimated additional revenue for 1952–53 was about £350,000. In a full year it would be about £920,000.

Mr. Williams also asked what additional revenue was expected from the proposed increases in charges for private telegraph and telephone services.

Mr. Gammans said that the figure for 1952–53 was £600,000.

Mr. B. Taylor asked what were the estimated financial results of the telephone service for 1951–52; and what additional revenue was expected from the proposed increase in rentals.

Mr. Gammans told Mr. B. Taylor that the estimated commercial surplus on the telephone service for 1951–52 was £4,300,000. The estimated additional revenue for 1952–53 from the proposed increase in exchange subscribers' rentals was £4,850,000 on a cash basis and about £6,000,000 on a commercial account basis.

Scottish Hydro-Electric Bill

The Hydro-Electric Development (Scotland) Bill has been read a third time in the House of Commons. Mr. Stuart, Secretary of State for Scotland, said that its purpose was to increase from £100 million to £200 million the statutory limit on the amount of borrowed money which the North of Scotland Hydro-Electric Board might have at any one time. The money was earmarked for existing schemes either approved or under construction. The total value of the work done in a year was regulated in accordance with the decisions of the Government on investment policy and that was a careful safeguard.

Report on Cables

Mr. Thorneycroft told Mr. Hale that he hoped to receive the Monopolies Commission's report on electric cables during April.

Power Cuts

Mr. W. Shepherd asked the Minister of Fuel and Power if he would state the number of power cuts made in the winters of 1949–50 and 1951–52 respectively.

Mr. Geoffrey Lloyd said he was informed that there were sixteen and four respectively.

Coal Stocks

In the course of a written reply Mr. Lloyd said that coal stocks at electricity works on 8th March were 4,030,000 tons, as compared with 2,610,000 on 10th March, 1951.

Space Heating

Mr. Nabarro asked the Minister of Fuel and Power what steps he proposed to take to discourage continuous space heating by electricity; and what steps were now being taken to implement the proposals in regard to domestic heating, contained in the Simon Report, 1946.

Mr. Lloyd said the Simon Report recommended that the main space heating load should be carried by solid fuel rather than electricity or

gas and various measures were proposed for the production of improved solid-fuel burning appliances and for encouraging their use. Numerous steps had been taken to implement these proposals. At present, a further review of the minimum standards of improved appliances was being undertaken in the light of recent research.

Gas and Electric Advertising

Mr. Osborne asked the Minister of Fuel and Power how far his committee on the co-ordination of publicity would ensure in the interests of economy that the expensively produced brochures advertising the greater use of gas and electricity should cease, since consumers were being asked to restrict the use of both services.

Mr. Lloyd said he had taken up the question with the Boards and the co-ordinating committee had reviewed the publicity arrangements generally. As a result he hoped that new principles would shortly be adopted and that purely promotional advertising would be discontinued.

Electric Vehicles Licence Fees

Mr. James Hudson asked the Minister of Transport whether, in view of the fact that "C" licences were no longer required for pedestrian controlled electric vehicles, he would arrange for the licence fees to be refunded and, if necessary, for the amendment of the regulations to make this possible.

Mr. Maclay said he would consider the suggestion and would communicate with Mr. Hudson as soon as possible.

Foundry Practice

SOME of the changes in equipment and cast metals which have taken place during the present century are surveyed in a paper presented by Mr. T. W. Bushell to the North East Coast Institution of Engineers and Shipbuilders last week.

After commenting upon the making of the "perfect casting" the paper briefly describes the recently completed new general foundry section of the works of Blackett, Hutton & Co., Ltd., at Guisborough, which is engaged on the production of general castings. Weights of up to approximately six tons can be dealt with. There are two electric melting furnaces (Electric Furnace Co., Ltd.) placed back to back, each having a normal capacity of three tons. They are fully automatic with self-adjusting electrodes and hinged roofs, which the author considers to be important items. Both furnaces are basic lined and the average melting time is about three hours.

The main object of the paper is to emphasize changes in methods, materials and treatment which have taken place while difficulties which can be encountered and have to be overcome in the production of steel castings are discussed. The paper ends with a commentary on methods of testing and inspection, in which connection the use of X-ray and gamma-ray examination is becoming the rule rather than the exception.

This means of inspection has much to recommend it, but the author believes its most important function is to shock the foundry into realization of how badly a casting can be made. Radiography is, however, not a cure-all for bad foundry practice. It must be remembered that a radiograph will show only defects which lie in a certain plane and only those if they are of sufficient magnitude to affect the passage of the rays. In other words, the radiograph will only show certain aspects of macroscopic faults.

Magnetic crack detection will only reveal those defects which lie on, or very close indeed to, the surface and its use is generally confined to the examination of machined or ground surfaces, particularly when tracing an obvious defect, preparing for welding, or after repair is completed. Experience is necessary for correct diagnosis, both in crack detection and radiographic examination.

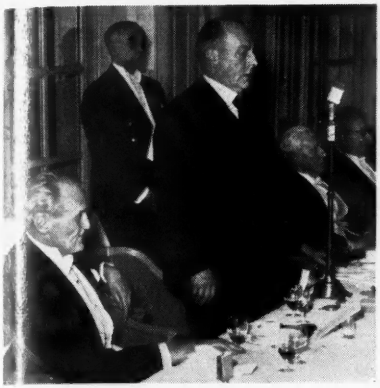
The Institute of Fuel

THE annual corporate meeting of the Institute of Fuel to be held at 4.30 p.m. on Wednesday, 23rd April, in the lecture hall of the Institution of Mechanical Engineers, will be followed at 5.30 p.m. by the presidential address of Dr. G. E. Foxwell entitled "Fuel Technology and Civilization."

The annual luncheon will be held on Thursday, 24th April, at the Connaught Rooms, London, W.C.2, when the principal guest and speaker will be Sir John Hacking (President of the Institution of Electrical Engineers).

ELECTRICAL WHOLESALERS

Speeches at Annual Dinner



Sir Herbert Williams speaking; on his right is the E.W.F. director (Mr. A. B. Wildsmith) and on his left Lord Citrine

BETWEEN four and five hundred people were present at the annual dinner of the Electrical Wholesalers' Federation at the Savoy Hotel, London, on 20th March. The principal guest was Sir Herbert Williams, M.P. Lord Citrine and Sir Henry Self represented the British Electricity Authority and the leaders of most of the organizations of the electrical industry were present.

The toast of the Federation was proposed by Sir Herbert Williams in humorous vein. He reminded his audience that about 150 yards from the Savoy Hotel the first public electricity supply authority in the world was started by Mr. Gatti, who employed d.c. distribution. This was soon followed by Dr. de Ferranti (whose son Sir Vincent de Ferranti was present) who introduced a.c. distribution in the face of great difficulties.

Sir Herbert went on to say that merchants did not advertise their functions to the general public. Business could not be carried on without them; they had to stock a wide range of goods and were thus truly anti-monopolists. Manufacturers sometimes did their own wholesaling but they found that it cost them as much as selling through wholesalers. Export trade could best be done by moderate-sized firms through export merchants. British traders should do more in their own defence.

In replying to the toast Mr. G. W. Cartwright, the president (who was in the chair), welcomed Sir Herbert Williams who had been the Federation's guest some years before the war and said that many historical events had occurred since then. Mr. Cartwright referred to the establishment of the Federation in 1914; then it met much opposition but to-day manufacturers appreciated that the members provided the most economical means of nation-wide distribution and representation.

Referring to the distribution difficulties of the British Electricity Authority, the president expressed the hope that the new power stations assisted by power from the North of Scotland Hydro-Electric Board would soon enable supply to overtake demand. He also looked forward to the time when the British electrical industry would rise from the position of the second largest exporting industry to the first place. In conclusion he thanked Mr. A. B. Wildsmith, director of the Federation, and his

The president (Mr. Cartwright) replies to the toast of the Federation

Left: **Sir Vincent de Ferranti responding for the guests whose health was proposed by Mr. W. H. Swain, on his right.** *Right*: **Mr. K. Scott Adie also replied for the guests. On his right is Mr. C. A. Hughes**

staff for their valuable assistance during his presidential year.

Mr. W. H. Swain, vice-president, proposed the health of the guests, referring particularly to Sir Herbert Williams and the representatives of other electrical associations with whom, he said, the E.W.F. worked in close harmony.

The first response was by Sir Vincent de Ferranti who said that the distribution of electricity required great skill and intelligence, as did wholesale distribution. Lord Citrine had the advantage, however, of never having any bad stock. Sir Vincent suggested that Sir Herbert Williams might do a little education among M.P.s on the subject of electricity in the home.

Mr. K. Scott Adie, president, Electric Light Fittings Association, who also replied, said that his association welcomed the continued co-operation of the E.W.F. He mentioned that when the E.L.F.A. came to prepare a wholesalers' register they found a thousand or so concerns all claiming to be entitled to wholesale terms. Without the help of the Federation they could not have cleared up that situation. Together they had established a voluntary basis of trading of great advantage to both parties and to the whole trading structure of the industry.

LIGHTING NOTES

FLUORESCENT lighting is to be extended from Main Street along Station Street and Station Road, WHITEHAVEN, states the *West Cumberland News*, which adds that the proposal is " unlikely to stir a murmur of opposition, so appreciated is the system installed in the main thoroughfare."

BOLTON Corporation Lighting Committee recommends that application should be made to the Ministry of Housing and Local Government for sanction to borrow £12,480 for improved lighting in Withins Lane, Ainsworth Lane, Spa Road and Crompton Way.

The first stage of BLYTH Town Council's plan for improving street lighting is to cost £5,600.

The Ministry of Transport has approved in principle the scheme for installing electric public lighting along the BRIERLEY HILL section of the main road between Dudley and Stourbridge.

ASHINGTON (Northumberland) U.D.C. is considering a scheme for changing the present hand switching of street lighting to automatic control.

GOSFORTH (Northumberland) U.D.C. has accepted the estimate of the North Eastern Electricity Board for street lighting in Church Lane, Gosforth.

A completely new installation of Metrovick " Poplar " lanterns using 45 W sodium discharge lamps has now replaced the German equipment for lighting the Lillebaelt Bridge linking the Danish island of Fuen and the mainland peninsula of Jutland. The bridge is 1,178 metres in length.

Application of Transductors

Their Use in Protective Gear

DURING recent years several papers have been published on the subject of transductors. These have been concerned mainly with the voltage operated type and particularly with their performance when applied as magnetic amplifiers. When transductors are operated from current sources, although their characteristics do not differ very much from those of voltage operated types, their field of application is widened.

In a paper read at a joint meeting of the Measurements and Supply Sections of the Institution of Electrical Engineers in London last week, Messrs. R. K. Edgley and F. L. Hamilton (both of A. Reyrolle & Co., Ltd.) described some of the many ways in which transductors could be used, not necessarily as amplifiers, to impart to simple relay elements some of the special characteristics required in protective gear work.

To illustrate more clearly the principles involved, especially for protective gear engineers who might not be familiar with transductors, the authors included some basic transductor characteristics. Special control arrangements and constructional features were considered and the main body of the paper contained descriptions of a number of practical applications of transductors as protective relays. The authors showed that the device was a very versatile component for protective systems but they did not advocate the replacement of all existing kinds of relays by transductor relays.

DISCUSSION

In the discussion Mr. A. H. Gray (Metropolitan-Vickers) said that time lags and harmonics could arise when a transductor was used as an amplifier and it might be wise to sound a note of warning in that connection because both of those characteristics could introduce difficulties. As regards the application of a voltage-operated transductor to a sensitive alarm relay, he suggested that that was an application which could be covered equally well by the ordinary moving coil relay which was much simpler. On the question of the transductor core, if it became saturated by a d.c. component it must experience a large flux swing and that in turn must produce a large e.m.f. across the output winding. That would appear to be capable of lowering the standard of stability unless some form of artificiality were introduced by slugging.

Although he agreed with the authors in their comparison of a transductor relay with the normal beam type of relay, Mr. Gray suggested that the transductor telephone-relay combination would suffer if compared with the modern moving coil relay with overlapping windings, because in such a relay the balance was perfect, and it was achieved in a rather more simple manner. The moving coil relay had two further advantages in that it was linear throughout the whole practical range, and its accuracy was not affected by any initial displacement of the coil.

Mr. G. W. B. Mitchell (Merz & McLellan) welcomed the advent of the transductor and said he had felt for a long time, particularly in the case of more complicated protective equipment of the high speed type, that it was desirable to reduce the number of moving parts. At the same time, the use of the transductor would in all probability lead to a considerable saving of space on panels which was another advantage. A case in which, in his view, the transductor should not supersede the present system was that of the D.M.I.T. over-current relay, despite the fact that there was some trouble experienced with the latter due to swarf getting in the magnetic gaps.

Mr. A. G. Milne (R.A.E., Farnborough) illustrated by slides some typical characteristics of the current operated transductor. He also referred to the development of rectifiers suitable for transductor work, but pointed out that the waveform of the voltage which would occur across the rectifiers had to be borne in mind.

Mr. P. Matthews (B.T.H., Rugby) said that the phase unbalance relay offered attractive possibilities, particularly if the ingenious adjustable time-lag relay could be used in conjunction with it to give the required time characteristic. The impedance relay was also an attractive proposition. He had found that with a somewhat different type of static reactance a difficulty was that a very small VA output was available per unit of departure from the impedance characteristic.

Mr. H. S. Petch (London Electricity Board) said he welcomed the authors' development of Mr. Fitzgerald's work. It was true that Mr. Fitzgerald was hampered by the non-availability of proper rectifiers, but Mr. Petch said he wondered whether it was appreciated just how much was owed to changing fashion. In 1920 when Mr. Fitzgerald was working on bias transformers the people who decided fashions in switchgear had a sort of battleship conception of switchgear and all the parts associated with it, and he felt certain that there would have been adverse comment on any suggestion to hang a number of megawatts of plant on telephone-type relays.

The chairman (Dr. L. Hartshorn) observed that electrical complexity had been developed during the war years to a stage previously undreamed of. It was being found that complexity did not matter very much and the most outrageous box of tricks could be made to work provided maintenance was properly planned.

Power Station Pumps

SPECIFIC hydraulic considerations which are fundamental to the operation of centrifugal pumps in steam power stations for circulating condenser cooling water, condensate extraction and boiler feed-water services are discussed in a Hydraulics Group paper compiled by Mr. R. Pennington (Mather & Platt, Ltd.) and presented at the general meeting of the Institution of Mechanical Engineers last week in London.

Simple empirical formulæ and practical diagrams aid the author to emphasize the importance of selecting the correct speed for reliable operation. The hydraulic gradient through a pump is represented diagrammatically to illustrate the meaning of the term " depression head " and to show how this is related to the throttling condition. It is claimed that in certain circumstances a pump can operate advantageously and safely at the throttling point, but otherwise it is essential to avoid what is described as the " cavitation area."

A relation is established between pump output, " depression head," and maximum permissible speed. The " speed coefficient " used in the formula is shown to depend on several factors. For circulating water pumps the relation between " depression head " and suction lift is illustrated. Maximum speed in relation to output and variation of pump type with specific speed and net head are presented graphically.

Diagrams and curves show the fundamental differences between operating methods of extraction pumps serving the two main types of surface condenser and de-aerators. Factors influencing the choice of speed are outlined.

A typical build-up of the pressure characteristics of a boiler feed system is explained and the requirements of the system are compared with the characteristics of the feed-pumps, both constant and variable speed, reference being made to the importance of arranging pressure-characteristics to ensure satisfactory parallel operation, load sharing and freedom from pressure surge. A formula is developed for calculation of the temperature rise across a feed-pump at any load and proposals are outlined for keeping this rise within safe limits. Special reference is made to the case of a feed-pump drawing directly from a de-aerator and the problem of avoiding vapour-locking with sudden fall in pressure. The main factors which determine the operating speed of a feed-pump are enumerated. Attention is drawn to the importance of, and means of constructing, the pump to withstand a sudden reduction of temperature without incurring casing joint leakages. The relative merits of placing the feed-pumps before or after the heaters are discussed and it is claimed that considerable thermal economy is achievable by using high-pressure heaters.

Safe Systems of Work

Some Legal Considerations

By C. F. MAYSON, A.M.I.E.E.

MANY engineers are, of necessity, only too familiar with the safety provisions of the Factory and Electricity Acts and Regulations. They are also generally aware that non-compliance with such provisions may lead to compensation being awarded by the civil Courts in the form of damages to an employee injured as a result. What is not always so clearly appreciated, however, is that an employer has a duty at common law to take care for the safety of his employees, whether or not any Act or Regulation applies, breach of that duty leading likewise to an award of damages by the Court.

Common Law Requirements

Knowledge of the common law rules regarding safety is not easily acquired and information gleaned from text-books on the law of negligence is liable to mislead those who have little or no legal experience, because the common law is based upon case-law which is constantly changing and rendering text-book statements out of date. The purpose of this article, therefore, is to set out in an understandable form the scope and principles of these duties as they are likely to affect engineers in the course of their work.

Every employer is in duty bound to provide a " safe system of work " and this is so whether the work is in a factory or elsewhere, and whether the employer is an individual, a firm or a company. The duty, in its most comprehensive meaning, includes the provision of safe and suitable plant and equipment, a safe place in which to work and a proper system and control of the work; in its more usual and restricted meaning only the last provision is included. There is also a fourth provision, the selection of fit and competent employees, but this has lost much of its importance since the abolition of the doctrine of common employment and the repeal of the Employers' Liability Act; nevertheless, it is wise to select competent workpeople if for no other reason than that an employer is vicariously liable for injury to an employee through the negligence of a fellow employee in the course of his duties.

It is well established that an employer who knows or ought to know that a machine is unsafe to use, and with that knowledge sanctions its use, is responsible for any injurious consequences. That is just common sense. But suppose the machine itself is inherently safe, though the process in which it is used is potentially dangerous. There is then a duty to see that the process is so worked as to eliminate, or at least reduce, the danger; in other words, a " safe system " must be inaugurated.

Definition of Safe System

What, then, is a safe system? It has never been precisely defined, but may be said to consist of a number of elements, including the layout of the job, the sequence of operations, the display of warning notices and the issue of special instructions. On an electrical job a safe system might include the issue of permit-to-work cards, the employment of a keyed interlock system, the provision of rubber gloves and earthing bars, or a set sequence of switching.

The test of a safe system is whether it renders an operation reasonably safe, and whether the exercise of due skill and care eliminates possible or probable danger. The obligation is not an absolute one, though the standard demanded is high. As to what that standard is can perhaps be gleaned from dicta in the Court of Appeal in a case concerning an accident to some high voltage testing equipment, which came within the scope of No. 4 of the Factory Act Electricity Regulations. Reg. 4 exempts from the Regulations

apparatus used, *inter alia*, for testing or research purposes,

> " provided such process be so worked and such apparatus so constructed and protected and such special precautions taken as may be necessary to prevent danger."

This proviso enforces what amounts to a safe system. Reading this literally, " it imposes an obligation to take precautions as may be necessary to prevent danger," but, " in operations of the kind contemplated, the complete elimination of danger must, on the face of things, be an impossibility." However, " precautions required to prevent danger can only be those which comply with the highest standard of safety which can reasonably be provided." This is, of course, in contrast to the generally held judicial opinion that when regulations impose specific precautions which, if properly carried out, render a particular machine or process virtually unworkable, then the use of that machine or process is effectively prohibited. It is extremely unlikely that this would be extended to cases where regulations do not apply.

Operation of Automatic Equipment

The use of automatic equipment is now common form where dangerous processes are concerned, and much ingenuity has gone into devising means of testing such equipment to ensure absolute reliability; " testing of tests " has even appeared! It is perhaps appropriate to quote the Court of Appeal again, to the effect that " the best possible test of the working of an [automatic] apparatus is the regular using of it."

The employer's duty, which is both personal and positive, is to decide what the system shall embrace and then to see that it is carried out. The obligation is a continuing one, so that modifications must be made as necessary to accord with changing conditions, and any particular occurrences or possible emergencies allowed for. He is not expected to guard against isolated acts of an employee outside the system: those day-to-day inadvertencies and omissions which occur in the course of a familiar routine, and of which he cannot be expected to know. But if, in fact, he does know of such departures from the system he has laid down, he is bound to take notice and correct them.

The system must be designed to protect not only those persons actually engaged in the operation, but also others in the vicinity. Protection of these others may consist of no more than putting up warning notices; but the fact that such persons, themselves engaged in a safe operation, have full knowledge and understanding of their exposure to danger does not permit the employer to dispense with the notices on the ground that the situation has been accepted by these employees.

Statutory Duties

Compliance with statutory duty, which may be of limited scope, does not necessarily absolve an employer from failure to provide a safe system. Further, facts which constitute breach of statutory duty may also amount to a breach of duty at common law. Thus, in a case involving a supply authority, it was held that insufficient screening of live busbars in a transformer kiosk not only constituted a breach of statutory duty (the kiosk being an " electrical station " within the meaning of the Act), but was also a breach of the common law duty of providing a safe place in which to work.

In proper circumstances, an employer may perform his duty of providing a safe system by pointing out to competent and experienced workmen that the provision of means of safety rests largely in their own hands. But he is not entitled to rely on the fact that a particular class of workmen usually take certain precautions; he must make certain that adequate precautions are actually taken. For example, a supply authority appointed an unskilled fitter an " authorized person " for the purpose of testing and operating e.h.v. switchgear. For some years previously this fitter had assisted skilled persons in the work and had observed that, before testing, certain protective panels had been removed, thereby exposing live metal. To his query as to possible danger, he received the reply, " If you don't take risks you can't get the job done." On appointment, the only instruction he was given was to make himself conversant with the Memorandum on the Electricity Regulations by the Senior Electrical Inspector of Factories. In carrying out a test in the manner with which he had become familiar through observation, he was seriously injured, and claimed against the authority on the ground of lack of a safe system. The Court held

that he do nothing more than to tell the fitter to read the regulations was not decisive a safe system, and it further held that, being unskilled, he was not himself negligent in following the example of his skilled predecessors.

Following by a very recent decision in the House of Lords, it would seem that the employer's duty of care is now extended to making special provision to allow for the shortcomings of individual workers. The case concerned a man with one good eye who received an injury to that eye and claimed that the system of work should have included the provision and use of goggles, despite the fact that the work was not of itself dangerous and did not call for any special protection. It was said that "the employer's duty to take reasonable care for the safety of his workmen is directed to their welfare and for that reason, if for no other, must be related to both the risk and the degree of injury. If the duty is that owed to an individual and not to a class, it seems to follow that the known circumstance that a particular workman is likely to suffer a graver injury than his fellows from the happening of a given event is one which must be taken into consideration in assessing the nature of the employer's obligation to that workman."

Employer's Responsibility

It matters not whether the employer is an individual or a company; personal responsibility remains and cannot be delegated. True, a company must, by its very nature, appoint an individual as its officer to perform the duty, but responsibility is with the company, which cannot hide behind its officer, however competent he may be. It may be noted that this is, in contrast to cases where it is specifically provided that statutory duties may be delegated, and where, if the employer can prove full and proper delegation, the employee to whom the duty was delegated cannot allege that an injury to himself was due to breach of that duty.

Duty of care is not all on the shoulders of the employer. The employee is himself under a common law duty to watch out for his own safety and to exercise the care of a reasonable and prudent man. Lack of such care may easily amount to negligence on his part and if it were shown that he sustained injury as a result of such negligence, he would be unable to recover compensation. Mere error of judgment or a degree of inattention would not normally amount to negligence, but it is always a question of fact how much the employee has himself contributed to his own injury and such contributory negligence is always taken into account by the Court when assessing damages. This doctrine applies equally whether the alleged breach is of a statutory or a common law duty.

When a question of failure to provide and maintain a proper system arises, it is essential to state precisely what the proper system is in the particular circumstances—and in what respects it is alleged that the system was not observed or fell short of requirements. The onus of stating what is the proper system is upon he who alleges the breach. The employer then has a good defence to a claim if he can show that the system put forward as a proper one is unreasonably onerous in the prevailing conditions and that the existing system is adequate for those conditions. Failure to adopt a particular type of protection, however well tried it may be, does not in itself constitute failure to provide a safe system, so long as the type of protection used is sound and that no defect has so far been apparent. But to say that a system is safe merely because it has existed for a long time and no accidents have resulted is not sufficient.

As always in legal problems, so much depends upon the particular facts of each individual case and it is virtually impossible to frame concise rules as to what does, and what does not, constitute a safe system of work. It is hoped, however, that these notes on the principles of the subject will be of service to those electrical engineers whose job is concerned with the means and methods of ensuring the safety of electrical equipment and of dangerous processes controlled electrically.

Television Relay

MIDDLESBROUGH General Purposes Committee has recommended the Council to accept the terms of Rediffusion (North-East), Ltd., for installing a radio and television relay service in the town. These provide for the payment of wayleave easements to the Corporation at 1s a year per Corporation house with a minimum of £500 and a guaranteed minimum income in wayleave rentals and rates of £20,000 over a 10-year period.

Poultry House Lighting

Successful Scheme at Wye College

By J. C. FOSTER*

IN December, 1950, a system of fluorescent lighting was installed in a new battery house at Wye College (University of London), Ashford, Kent, to give artificial extension to normal winter daylight hours. In view of its success, a few notes on the installation may be of interest to potential users.

The building, housing seven standard Visi Chick batteries each containing eighty-four birds, has internal dimensions of 60ft by 25ft and is of standard construction, viz., concrete block walls, timber window frames and sashes, angle-iron purlins and roof trusses. It is roofed with corrugated asbestos sheet and painted internally for cleanliness and light reflection with two coats of " Snowcem."

Timber Troughs

A system of indirect lighting is employed involving the use of four 8ft 120 W fluorescent tubes spaced centrally and at equal distances along the building. Timber trough reflectors made to accommodate each tube are suspended from the roof 8ft above the floor. The upper edges of the trough coincide with the upper surface of the tube and thereby give a light cut-off below the horizontal plane. The trough reflectors are of simple construction in ¾in deal, and are primed and painted inside and outside. The inside is finished a flat white and fitted with two spring clips to carry the fluorescent tube. To render the fitting dustproof, one corrugation cut from a sheet of " Perspex " is screwed to the upper edges of the trough.

The equipment associated with each fluorescent tube, with the exception of the starter switch, has been built into a dust-proof box and suspended by galvanized chains from the purlins immediately above the tube. The starter switch is mounted externally for ease of replacement. Flexible t.r.s. leads are used between the equipment and the tube fitting, and between the equipment and a three-pin 2 A socket.

Wiring has been carried out using a system of galvanized steel conduit which is run on the upper purlin from end to end of the building. Eight three-pin 2 A sockets are fitted at equal distances apart for the tube connections, so that a maximum of eight tubes can be connected if necessary.

Sequence Switching

Automatic switching off of the tubes was considered a necessity, and therefore a 5 A Venner time switch has been fitted. With slight modification to the switching arms a switching sequence corresponding to " on " and " off " twice in twenty-four hours has been obtained, viz., 5–7 a.m. and 4.30–7 p.m.

A check on light intensities at various levels from the floor reveals an illumination factor of 2 ft-candles at a level corresponding to the bottom row of birds, 3 ft-candles at the second row level, and 4 ft-candles at the top row level. Between the centre of any row and the corresponding ends it has been found that there is a difference of only 0·5 ft-candle.

To improve and maintain uniform atmospheric conditions in the battery house, two 15in extractor fans each capable of displacing 2,250 cu ft/min have been fitted in the ridge, with their associated speed control equipment fixed at a convenient height from the floor.

The entire electrical installation has been designed and installed by the College Maintenance Department in collaboration with the Professor of Agriculture and the Registrar of the College.

* College engineer, Wye College.

Fluorescent Lighting in Canada

Our Montreal correspondent reports that a fluorescent street lighting installation now operating on a trial basis in Etobicoke township is believed to be the first in the country.

Commerce and Industry

Young Cable Makers' Wages

Plant Engineers' Conference Programme

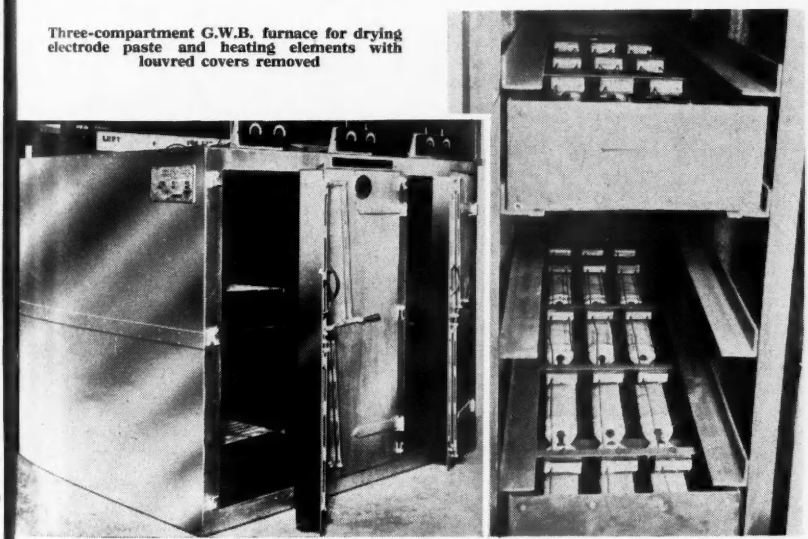
The National Joint Council for the Electrical Cable Making Industry has announced revised rate scales for employees under adult age. The new scale for males ranges from 42s 2d per week (11·5d per hour) at the age of fifteen to 97s 2d (26·5d per hour) at the age of twenty. The rate for females ranges from 40s 4d (11d per hour) at the age of fifteen to 57s 9d (15·75d per hour) at the age of seventeen. The revised scales will come into effect on the third pay day in April in respect of the period for which payment is made on that day.

Accountancy and Changing Prices

Price fluctuations, the high rate of taxation, and the ever-growing demands for higher wages and dividends—which are based on money profits—have emphasized the need for a more accurate indication of the true profits of an enterprise. The problem is one of concern to business men and accountants in this country, and the London Area Committee of the Institute of Cost and Works Accountants has invited an eminent French accountant, Monsieur François M. Richard, to discuss the steps taken by the French who have had the problem with them for a generation. M. Richard will address a meeting at the Beaver Hall, Great Trinity Lane, London, E.C.4, on 1st April, at 5.15 p.m. Tickets of admission may be obtained (gratis) from the Director, Institute of Cost and Works Accountants, 63, Portland Place, London, W.1.

Unusual Electric Oven

There has recently been exported to Rhodesian Alloys, Ltd., at Gwelo, S. Rhodesia, an electric oven manufactured by G.W.B. Electric Furnaces, Ltd., of Dudley, for an unusual process. It is to dry Soderberg paste before it is formed into electrodes for alloy steel melting furnaces. There are three compartments with four sets of runners, each to carry two charge pans. The depth of the oven is 5ft 3in, width between runner angles 1ft 6in and the height 5ft. The total rating of the oven is 36 kW, each compartment being loaded at 12 kW in two 6 kW banks of nickel-chromium wire elements wound on refractory formers. The elements are



Three-compartment G.W.B. furnace for drying electrode paste and heating elements with louvred covers removed

arranged for easy removal for periodic inspection. The body of the oven is of double cased sheet steel construction, the space between the inner and outer sheets being packed with slab insulation. The central compartment is also separated from the other two by insulated panels. This arrangement, coupled with the fact that each chamber has its own isolator, switchgear and temperature indicating control thermostat, makes independent operation possible.

The operating temperature ranges from 100 to a maximum of 220 deg C and, as an added safety precaution, a second Teddington variable type thermostat is fitted in each compartment to act as an excess temperature device to cut off the electricity supply in the event of accidental overheating.

Locomotives for Tunisia

Delivery of thirty-three diesel-electric locomotives of 600 h.p. to the Tunisian Railways has now been completed. These Sulzer-engined units weigh 51 tons, and are for passenger and mineral trains at speeds up to 45 m.p.h. in districts where the summer temperature rises to 125 deg F. They are working on all lines south and south-west of Tunis.

Welding, Brazing and Soldering Copper

An 188-page practical handbook dealing with the jointing of copper and copper alloys has been issued by the Copper Development Association, Kendals Hall, Radlett, Herts. After treating in an elementary manner some of the relevant properties of metals, separate chapters are devoted to fusion welding, bronze welding, brazing (including some notes on the copper brazing of steel) and soft soldering. All the major processes and many others are described in considerable detail and examined as to their suitability for copper and its alloys. The last chapter, which is concerned with the jointing of dissimilar metals, is followed by a comprehensive bibliography and some useful tables. Like all other publications of the Association, this book, which contains 81 illustrations, is free to those to whom it can be of service.

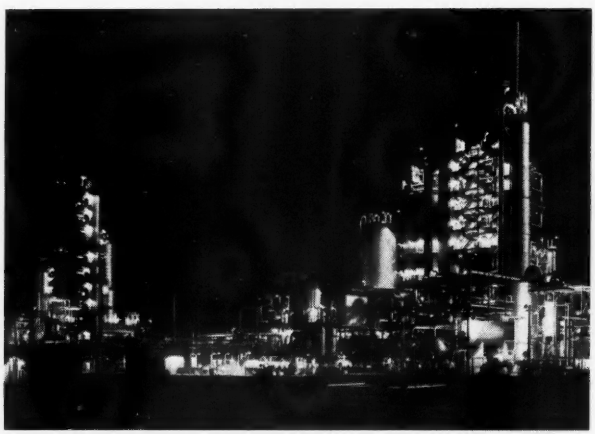
Commercial Food Mixer

The success which attended the showing of the prototype model of the "Chef Major" commercial food mixer by Kenwood Electrics, Ltd., at the recent Hotel, Restaurant and Catering Exhibition, has been followed up by a private showing to the Press in London last week. Mr. K. N. Wood, in welcoming the Press representatives, mentioned that the mixer had now reached the production stage and they hoped to have it on the market within the next six months. The mixer, which was briefly referred to in our review of the Hotel and Catering Exhibition, is housed in a cabinet of heat and steam resistant "Formica." Inside the cabinet are fitted two power units for driving three power outlets providing mixing, whisking, beating, mincing, liquidizing, chopping, dough kneading, etc., while additional attachments are being developed for potato peeling and chipping, dicing, grating and shredding of vegetables, slicing, coffee grinding and juice separating. The mixer motor is of $\frac{1}{3}$ h.p. and the liquidizer motor $\frac{1}{2}$ h.p. The bowl capacity is 10 and 20 quarts and the liquidizer capacity 2, 4 and 8 litres.

Lighting of Fawley Oil Refinery

Further details are now available of the lighting of the "Esso" oil refinery at Fawley (*Electrical Review*, 21st September, 1951, page 579). Altogether about 3,000 "Metrovick" lighting units have been installed throughout the plant, flameproof type equipment being used in the hazardous areas and vapour-tight equipment in the non-hazardous areas. The 1,700 vapour-tight well glass units employed mainly for exterior lighting in the non-hazardous areas have a cast aluminium top, vitreous enamelled steel reflector and a galvanized wire guard.

A vapour-tight gauge glass fitting for two 25 W



Night view of the "Esso" oil refinery at Fawley

Some of the exhibits at the Brook Motors Suggestions Exhibition

tubular lamps was specially developed for this installation and more than 600 are in use. These units are generally used in groups of three or more, in line behind tubular glass gauges. The fitting consists of a silicon aluminium conduit box to which is fixed a cast lamp housing with a recessed glass panel curved and lightly frosted on the inside. One hundred and eighty cast silicon aluminium alloy floodlights with 500 1,000 W B2 projector lamps floodlight the jetties, separators and other similar sections of the plant. Other equipment includes " Trafford " street-lighting lanterns for general road lighting and fittings for control room and boilerhouse lighting.

Plant Engineers' Conference

The annual conference of Incorporated Plant Engineers will be held at the Grand Hotel, Harrogate, from 21st to 23rd May. On the first day there will be a civic reception and ball. The conference will be officially opened by the Mayor of Harrogate on the second day and the programme will include the annual general meeting, the presidential address by Mr. G. A. Rooley on " The Plant Engineer and Production Costs," and papers by Mr. D. Holland on " The Functions and Responsibilities of the Works Engineer," and Mr. A. Whittick on " The Civil Engineering Programme and the Machines for the Work." The annual dinner, dance and cabaret will be held in the evening. On the third day the adjourned annual general meeting will be followed by the presentation by Mr. J. E. Duckham of the 1952 Alexander Duckham Memorial awards. An interesting programme has been arranged for the ladies.

Brook Motors Suggestions Exhibition

To stimulate interest in the works suggestion scheme, Brook Motors, Ltd., are holding an exhibition in the canteen. Since the scheme was started two years ago about five hundred suggestions have been received and a high proportion accepted. One pound is paid on acceptance and a further annual award of £10 is made for the best suggestion of the year. Included in the exhibits are an asbestos disc used for quick removal of turnings from the chucks on automatic multi-spindle machines, an air cooling device which saves grinding operations and lengthens the life of carbide tipped tools, and two methods of saving time and material on the dynamic balancing of rotors and slip rings.

Refrigerator Imports

In a comment in our last issue (p. 594) we stated that refrigerators of a capacity exceeding 7 cu ft had been removed from the Open General Import Licence. Actually the item " Refrigerators " in the Licence has been amended to read " Refrigerators of a capacity exceeding 7 cu ft "; therefore it is the smaller types which now need import licences.

Industrial Information

Measures to stop the waste of time and money that results in all branches of industry from ignorance of facts already established and published formed the subject of a conference on " Information Services and Industry " held in London on 18th March under the joint auspices of the Industrial Research Committee of the Federation of British Industries and Aslib. Sir Alfred Egerton, F.R.S., Head of the Department of Chemical Engineering and Applied Chemistry, Imperial College of Science and Technology, headed the team of speakers, and the conference was held under the chairmanship of Mr. A. H. Wilson, F.R.S., chairman of the F.B.I. Industrial Research Committee. After

lunch, delegates were conducted round information departments of firms in the London area.

Keeping track of information daily directed towards industry in reports, Government Orders, and technical journals, is, as emerged from the comments of successive speakers, a science for which special training is required. Rapid access to technical, statistical, legal, or other information is a daily need of most industrial firms, large and small.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £148 0s 0d
COPPER, H.C. Electro	ton £227 0s 0d
Fire Refined 99·7 per cent ..	ton £226 0s 0d
Fire Refined 99·2 per cent ..	ton £225 10s 0d
COPPER Tubes	lb 2s 2d
Sheet	ton £280 0s 0d
H.C. wire and strip	ton £254 0s 0d
LEAD, English	ton £164 10s 0d
Foreign	ton £163 0s 0d
MERCURY	flask £73 10s 0d
TIN	ton £961 0s 0d
ZINC, G.O.B. Foreign	ton £190 0s 0d
Electrolytic	ton £194 0s 0d
BRASS Tubes	lb 2s 1d
Sheet	lb 2s 4½d
Wire	lb 2s 7½d
PHOSPHOR BRONZE	
Wire	lb 3s 7½d
RUBBER, No. 1 R.S.S. spot ..	lb 33½d–34d

Trade Announcements

The address of the **Acru Electric Tool Mfg. Co., Ltd.,** is now Chapel Street, Stockport Road, Levenshulme, Manchester (telephone : Rusholme 4613).

Smart & Brown (Engineers), Ltd., announce that Mr. M. Parker, Cheshunt, Herts, Mr. D. A. Norris, Wimbledon, S.W.20, and Mr. R. C. Mackenzie, London, S.E.15, have been engaged as representatives to cover London and the Home Counties. They will operate from the company's office at 8, Rose and Crown Yard, King Street, St. James Street, S.W.1.

South African Import Control

A message from the United Kingdom Senior Trade Commissioner in Pretoria, reported in the *Board of Trade Journal*, says that the 1952 import quotas for consumer goods will be 40 per cent by value of 1948 imports instead of 60 per cent as for 1951. Special permits will be issued for certain scarce goods.

"Permit to Work" Error

Last week Mr. A. L. Petty, a shift engineer at Stockport power station, was fined £10 upon a summons charging him with issuing a permit to work on an electric circuit when it was unsafe to do so. An electrician, Mr. D. Henshaw, stated in evidence that he was instructed to trace a fault. He was given a permit by Mr. Petty certifying that the circuit was "dead" and safe to work upon. He proceeded to earth the 6·6 kV conductors; there was a flash, the back of his left hand was burned and his glasses were also destroyed. Mr. Henshaw said that before the accident he had suffered from rheumatoid arthritis but it had now disappeared.

Mr. Petty admitted that the permit was incorrectly made out; it covered only the low-voltage side of the main feeder. The accident occurred when Mr. Henshaw removed a panel to gain access to the h.v. circuit.

Australian Import Restrictions

Full details of the import restrictions recently imposed by the Australian Government are published in the *Board of Trade Journal* of 22nd March. Goods are divided into three classes—Category "A," in which the quarterly quota for importers will be at the rate of 15 per cent (i.e., 60 per cent per annum) of their importation during the financial year 1950–51; Category "B," for which the quarterly quota will be 5 per cent (20 per cent per annum); and "Admin.," comprising goods which do not lend themselves to quota treatment.

Lighting "Visors"

In our description of the lighting at Boots printing works, Nottingham (21st March issue), we mentioned that some of the fittings were equipped with visors. The Benjamin Electric, Ltd., informs us that the word "Visor" has been one of its registered trade marks since 1929.

Ideal Home Exhibition

Clang electrical accessories have been installed throughout the Coates house at the Ideal Home Exhibition. Particular interest has been aroused by demonstrations of the ejector plugs and dimmer switches.

Catalogues and Lists

Uni-Tubes, Ltd., Alpha Works, Alpha Street, Slough, Bucks.—Descriptive leaflet on "Kopex" conduit, including prices.

Rawlplug Co., Ltd., Rawlplug House, Cromwell Road, London, S.W.7.—22nd edition of the "Rawlplug" fixing devices brochure.

Dale Electric (Yorkshire), Ltd., Electricity Buildings, Filey, Yorks.—Catalogue describing the present range of automatic a.c. generating plants.

Franco-British Electrical Co., Ltd., 15-17, King Street, St. James's, London, S.W.1.—Illustrated leaflets on the new Franco "Diffluor" lighting fittings and "Plexilux" (formerly "Prismalux") fittings.

OVERSEAS ELECTRICAL TRADE

Exports in February Maintained at High Level

THOUGH not reaching January's record of £17,016,936, last month's total for exports of electrical apparatus and machinery, at £16,367,312, shows little diminution in trading when allowance is made for the fewer working days. In view of the recent announcement of cuts in Australian imports it cannot be expected, however, that this high rate of export can be maintained unless other markets can be expanded. Recently Australia has been our best customer, last year accounting for one-ninth of the total overseas sales of goods and apparatus and over one-sixth of the electrical machinery: probably the biggest effect of the restrictions will be in the former classification.

A measure of the improvement in business during the past twelve months is gained from a comparison of last month's figures with those of February last year. The total is no less than £6,187,639 higher, the progress made being particularly striking in the goods and apparatus section,

TABLE I.—ELECTRICAL EXPORTS

Class	February, 1951	February, 1952
	£	£
Telegraph and telephone cables and wires (submarine)	93,699	9,489
Ditto, not submarine	453,547	448,547
Wires and cables, paper insulated	316,886	903,466
Ditto, rubber insulated	320,842	654,074
Ditto, cotton, silk or artificial silk insulated	34,484	70,133
Ditto, enamel, glass or asbestos insulated	70,900	105,227
Ditto, other	184,473	305,879
Commercial radio apparatus	272,670	508,210
Domestic radio apparatus	254,230	393,229
Telegraph, telephone and signalling apparatus	1,170,800	1,473,940
Radio loudspeakers	36,241	98,511
Telecommunication components, n.e.s.	341,431	687,603
Other telecommunication apparatus	91,377	114,313
Valves and cathode ray tubes	200,333	335,042
Carbons	25,417	42,596
Lamps, exceeding 24 V	64,466	109,740
Ditto, not exceeding 24 V	33,115	49,545
Other lighting appliances	275,055	461,444
Primary batteries	120,559	198,112
Parts other than carbons	36,008	36,437
Accumulators for motor vehicles	144,195	388,512
Ditto, traction	8,593	39,962
Ditto, radio	5,329	4,000
Other portable accumulators	26,174	104,175
All other accumulators	10,170	70,820
Parts and accessories	69,481	57,983
Cooking appliances	97,656	354,014
Heating appliances	68,554	89,157
Parts and accessories for cooking and heating appliances	61,205	95,574
Flat irons	49,012	69,626
Commercial electrical instruments	124,994	134,278
House service meters	81,826	147,172
Time recorders and time switches	25,992	6,853
Other electrical instruments	95,088	113,500
Electro-medical apparatus (not X-ray)	40,819	45,018
X-ray apparatus, tubes and parts	118,108	196,049
Permanent magnets	24,799	33,655
Insulating cloth and tape	72,912	122,455
Other insulating materials	83,706	124,161
Unclassified electrical goods and apparatus	333,327	539,045
TOTAL electrical goods and apparatus	5,948,473	9,741,546
Diesel driven generators not exceeding 200 kW	241,569	436,377
Ditto, exceeding 200 kW	108,665	145,479
Other generating sets	104,667	485,476
Generators exported without prime movers, and parts of generators	255,138	355,530
Motors, railway, tramway and trolley bus	5,586	8,560
Ditto, other not over ½ h.p.	124,166	174,011
Ditto, over ½ h.p. but under 1 h.p.	57,235	110,562
Ditto, from 1 h.p. to 250 h.p.	333,164	465,293
Ditto, exceeding 250 h.p.	53,122	79,441
Ditto, parts	67,231	107,967
Converting machinery	5,347	13,669
Transformers, including coils	530,888	954,935
Rectifiers for power house use	63,752	79,547
Motor starting and controlling gear	159,199	240,649
Switchgear and switchboards (not telegraph and telephone)	1,018,600	1,180,233
TOTAL, electrical machinery	3,128,329	4,837,729
Washing machines (not exceeding 250 lb weight)	417,028	645,156
Ditto, parts	18,776	24,271
Vacuum cleaners	175,910	202,162
Ditto, parts	35,914	57,773
Other electrically operated portable appliances and parts	143,472	352,984
Portable electric tools	71,261	128,284
Unspecified electrical machines, machinery and parts	240,510	377,407
GRAND TOTAL	10,179,673	16,367,312

exports of which rose from £5,948,473 to £9,741,546. True to form, Australia accounted for £1,484,882 worth (more than twice as much as in February, 1951), with India taking £906,624 (£441,642), and South Africa £893,528 (£350,265). Better business was again done with Canada (£201,726 compared with £108,590), but sales to the United States showed a slight decline (£114,070 compared with £126,516). Greece increased its requirements from £21,078 to £132,309 worth.

It will be seen that only three classifications out of the whole sixty-two covered in Table I show reduced sales: telegraph cables and wires, both submarine and other, and time recorders and time switches. In the cable market India (£75,289) and New Zealand (£60,740) were the biggest buyers of telegraph and telephone cables other than submarine. Australia (£285,008) and India (£186,412) took most of the paper insulated type, New Zealand (£94,610) and South Africa (£67,167) being the best markets for rubber insulated kinds.

Greatly increased purchases by Sweden (from £47,739 to £107,003) and India (from £7,059 to £77,961) were largely responsible for the rise in value of commercial wireless sales from £272,670 to £508,210, while South Africa helped substantially in the advance in the domestic radio sales from £264,230 to £393,229. Australia (£315,465) was well ahead of South Africa (£146,488), the next largest buyer of telegraph, telephone and signalling equipment. The same applies to cooking and heating appliances, these two countries taking £249,701 and £45,282 worth out of a total of £538,745. India (£48,043) and South Africa (£45,827) were the largest buyers of electrical instruments.

Russia's purchases of generating plant showed an increase over the corresponding month of the previous year—from £30,153 to £40,728. The amount is, however, a comparatively small item in a class with a total amounting to £1,422,862 and is well below the largest customers, Australia (£229,030) and India (£216,370). In February, 1950, Russia's purchases were valued at £1,053,002.

Big advances in the demand for motors in the classes above ⅓ h.p. were mainly responsible for the rise from £640,504 to £945,834 in exports of motors. Of this total £246,167 went to Australia, which also took £518,681 of the £2,469,033 worth of other electrical machinery.

Table II.—Distribution of Electrical Goods and Apparatus

Destination	February, 1951	February, 1952
	£	£
Channel Islands	53,040	35,634
Gibraltar	32,243	12,199
Malta and Gozo	5,202	15,769
Cyprus	23,168	53,279
British West Africa	92,892	178,612
Union of South Africa	350,265	893,528
Northern Rhodesia	15,426	31,272
Southern Rhodesia	56,340	136,553
British East Africa	306,152	280,157
Bahrein, Qatar and Trucial Oman	14,894	24,816
Kuwait		32,126
India	441,642	906,624
Pakistan	178,166	217,548
Malaya	261,833	324,256
Ceylon	62,101	118,278
Hong Kong	134,415	260,035
Australia	705,224	1,484,882
New Zealand	308,835	519,597
Canada	108,590	201,726
British West Indies	75,863	144,437
Anglo-Egyptian Sudan	22,022	63,172
Other Commonwealth Countries	38,201	82,784
Irish Republic	240,047	284,650
Soviet Union	15,220	45,425
Finland	142,266	96,006
Sweden	157,868	277,011
Norway	104,736	130,462
Iceland	6,295	6,115
Denmark	112,785	125,510
Poland	32,384	13,072
Germany	51,623	30,224
Netherlands	195,653	311,210
Belgium	74,382	127,080
France	85,914	109,839
Switzerland	47,267	42,514
Portugal	57,168	127,645
Spain	5,905	33,502
Italy	45,627	84,023
Austria	53,481	19,760
Czechoslovakia	19,341	17,742
Greece	21,078	132,309
Turkey	84,760	107,502
Portuguese East Africa	1,435	18,147
Syria	20,607	5,856
Lebanon	8,976	14,056
Israel	8,242	76,395
Egypt	160,914	137,925
Arabia	4,409	26,623
Iraq	54,209	64,633
Iran	139,630	16,405
Burma	19,117	41,259
Thailand	31,280	97,592
Indonesia	11,187	22,613
China	20,892	9,106
United States of America	126,516	114,070
Venezuela	69,056	74,107
Peru	55,314	22,039
Chile	5,941	40,729
Brazil	72,661	306,542
Uruguay	21,425	24,699
Argentine Republic	140,004	185,615
Other Foreign Countries	136,344	304,250
Total	5,948,473	9,741,546

Peruvian Tariff Reductions

Ad valorem import duties on a number of classes of goods, including a wide range of electrical appliances and equipment, are being reduced by the Government of Peru. In general the reduction is from 13½ to 12½ per cent and the specific duties, also levied, remain unchanged.

Supplementary Power Sources

Review of Experimental Schemes

AT a meeting of the Royal Society of Arts on 19th March a paper was presented by Mr. C. W. Marshall (British Electricity Authority) on supplementary sources of power: wind; volcanic heat; thermal energy from the sea; solar energy (radiant); and tides—that being the order, he believed, of their probable practical applications.

Existing wind generators, he said, were usually less than 1 kW in capacity, but one manually controlled unit of 100 kW was erected at Yalta (U.S.S.R.) in 1931. The largest yet built was a 1,250 kW machine installed at Grandpa's Knob, Vermont (U.S.A.), which failed owing to propeller blade fracture caused by vibration after 838 hours of operation in parallel with an a.c. power system; it had not been a financial success. French engineers had built plants up to 40 kW. In Denmark, on account of lack of fuel during the war, 88 wind-driven generators were in use in 1944. The largest d.c. machine, rated at 30 kW with a wind speed of 22 m.p.h., had a four-blade propeller 59ft in diameter. A 50 kW alternator was driven by a two-blade propeller, 58ft in diameter.

British Wind Power Investigations

Wind energy might be economically used in Great Britain because of the high average wind speeds on the west coast and because of the ability of the grid to absorb the electrical output. Surveys conducted by the Electrical Research Association indicated that an annual output of 4,000 kWh per kW of installed capacity should be obtainable, which the B.E.A. considered should be worth 0·4d/kWh as non-firm power delivered at 11 kV to the grid. The E.R.A. had tentatively concluded that the most economical capacity for connection to the grid would be from 1,000 to 2,000 kW, but this was far in excess of anything yet constructed that was light and cheap and yet strong enough to withstand gales.

The use of more than one propeller was regarded as essential for any size of machine. An experimental 100 kW geared asynchronous generator had been erected at Costa Head, Orkney, by the North of Scotland Hydro-Electric Board; the propeller was three-bladed. A second machine of the same rating had been ordered by the B.E.A. (*Electrical Review*, 21st March, page 610). Its weight would be 35 tons, or 770 lb/kW compared with 22 lb for coal-fired steam plant which, however, would use 4,000 lb of coal/kW per annum. About 3,000 sq ft must be swept by a propeller to obtain 30 kW from a 30 m.p.h. wind and the structure had to be able to withstand at least ten times normal stresses once every year or so. It was possible that as much energy could be obtained from the wind as was now obtained from hydro-plant south of the Clyde–Firth line.

Natural Steam

Saturated steam, ejected at from 220 to 270 lb/sq in from boreholes, associated with volcanic manifestations, had been used at Larderello in Italy since 1920 for the generation of electricity. Maximum delivery was 180 tons/hr. The newest station contained four 26 MW turbo-alternators using natural steam directly at 70/sq in (abs) and 330 deg F. Condensers were evacuated by turbo-exhausters. Output from the Larderello plants had increased from 5 million kWh in 1920 to over 1,000 million kWh per annum at the present time. Regions of thermal springs in Great Britain might offer possibilities in view of the cost of coal now.

A project for exploiting the differences between the temperatures of the deep and surface waters of the sea (suggested by Claude) was being sponsored by the French Colonial Ministry and the National Scientific Research Centre. Messrs. Beau and Nizery had developed a scheme in which water at 82 deg F would be taken from the surface of the sea. The steam derived from it would drive two 3,500 kW turbines, the exhaust from which would be condensed by water at 46 deg drawn

through an 8ft diameter pipe from a depth of 1,300ft 2½ miles from the power station. This station was intended to provide the base load supplies for the Abijan area of the Ivory Coast and to operate in parallel with a normal thermo-electric generating station. Water consumption was expected to be 11,400 lb/kWh. The turbine and jet condenser would be kept in a very high vacuum. The turbine would comprise a single horizontal wheel with an increasing degree of reaction from the shaft to the circumference. The weight of materials required would amount to about ¼ lb/kWh per annum—about that for ordinary hydro-stations, but much greater than that for wind generators.

Solar energy had been trapped in sunny regions in the United States for producing heat comfort and domestic hot water. Efficiency was estimated at 48 per cent for a radiation intensity of 300 B.Th.U./sq ft/hr falling to zero for 100 B.Th.U. When the heat absorbing surface of a heat pump received the solar radiation corresponding efficiencies were 63 and 43 per cent, assuming temperatures of 120 deg F for the collector and 20 deg F for the external air. Water, air and earth were all being tried as heat reservoirs, the earth being the most interesting. At the Philip Sporn generating station, West Virginia, the heat pump had been applied to a water distillation plant. A 400 h.p. centrifugal compressor rated at 2,150 cu ft/min received vapour at 60 lb/sq in (abs) and discharged it at 85 lb/sq in (abs) to a condenser coil submerged in the evaporator shell. The saturation temperature thus maintained within the condenser was sufficient to support distillation in the evaporator. The maximum output of the distilling unit was 17,600 lb/hr and the coefficient of performance ranged, with the load, from 15 to 20. Heat pumps of several hundreds of horsepower were becoming increasingly common in parts of the U.S.A. where they could be used for cooling in summer and heating in winter.

The final supplementary source described was the tidal energy of the River Severn estuary. The scheme envisaged the installation of thirty-two 25 MW hydro-alternators with a peak output of 800 MW, about twice the capacity of Battersea power station, and an annual production of 2,207 million kWh, which was 4 per cent of the present total for the country. Tidal energy did not provide firm power and costs of construction and more easily obtainable and cheaper coal formerly prevented its being competitive with thermal power. Ten years might elapse before main construction could begin, as many factors had to be studied, including the long-term effects on the river channel.

Mr. Marshall concluded by observing that the limited resources of manpower and materials were very properly being expended on more immediate and fruitful means of improving the position than was possible by developing supplementary resources. He hoped, however, that some small proportion of mental effort would be devoted to solving problems which could bring returns only after many years.

Electronic Telephone Exchanges

IN reporting the discussion on the I.E.E. Radio Section paper on this subject in our last issue the remarks of the concluding speakers were inadvertently omitted.

Mr. G. H. Foot (Mullard) suggested that it would be of interest to approach the problem by considering a large system, with the long-distance dialling involved and see what were its special requirements and whether they could be tackled by electronic means, perhaps in a totally different way, rather than to proceed from the present switches, analysing them and then attempting to copy them. The most useful concept was that each call carried a label with the address of its destination and travelled by the most direct route unless there was congestion. When a connection had been established, why must it be broken down at the end of the conversation? It might be needed for most of its distance. Could not calls which were going the same way be collected in bundles of twelve and switched?

Mr. R. W. Palmer (Post Office) appealed for a realistic approach to the maintenance problem, which, he said, was as much the job of the designer as the reliability of the components.

Sir Archibald Gill said that this was an historic occasion, the first time that electronic telephone switching equipment had been shown openly at a meeting in this country. He hoped that further development would take place as actively as possible. In the past there had been many inventions and discoveries in this country which had been taken up abroad, brought to fruition and sold back to us at a high price. We should go ahead and develop this electronic exchange, and possibly it might be tried out in the Post Office Engineering Department in the same way as the first automatic telephone exchange in this country.

RECENT INTRODUCTIONS

NOTES ON NEW ELECTRICAL AND ALLIED PRODUCTS

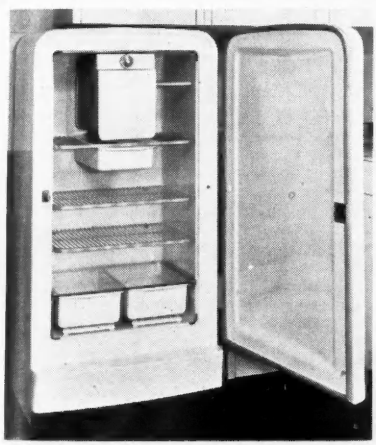
Brooch Microphone

A BROOCH type microphone has been introduced by JOHN BELL & CROYDEN, 117, High Street, Oxford, for use with the "Belclere" model 101 miniature hearing aid. Several forms of brooches are available employing either a filigree silver pattern or a handpainted silver plaque with a deposit enamel finish. For men an unobtrusive lapel badge is available. The separate microphones are offered as an optional standard with the model 101 instrument at no extra cost.

Refrigerator

The new "Coldrator" CS.70 domestic refrigerator brought out by the INTERNATIONAL REFRIGERATOR CO., LTD., Fletton, Peterborough, has a 7·1 cu ft capacity and a shelf area of 13 sq ft. It is designed to stand on a floor area of 27½in by 24½in. Like other models of the "Coldrator" range, the hermetically sealed system is employed. The cabinet is finished in durable white stoved enamel and the storage compartment is white vitreous enamelled and heavily insulated. A trigger latch mechanism (with a lock) permits the door to be gently closed without slamming and yet ensures a close seal.

The stainless steel freezer is of the two section locker type, one section for storing 15–20 lb frozen food and the other for freezing 3 lb of cube ice per freezing. A separate compartment below the glass shelf has a storage area which provides the cool and moist conditions for salads and other foods needing high humidity. The interior of the cabinet is lighted automatically when the door is opened. The price is £95 (plus £49 12s purchase tax in the United Kingdom).

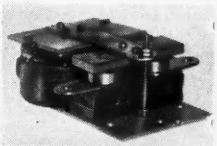


Left: "Coldrator" CS.70 refrigerator

Right: Unity "Snug" type "Floodwarmth" convector

Midget Contactor

Among the products recently introduced by the ELECTRICAL REMOTE CONTROL CO., LTD., 13 and 15, Evanston Avenue, Highams Park, London, E.4, is a midget contactor, type HDD, for low voltage d.c. operation. The efficient magnetic circuit has enabled the size of this "ElRemCo" device to be kept down to 4¼in by 3½in by 1⅝in. The current switching

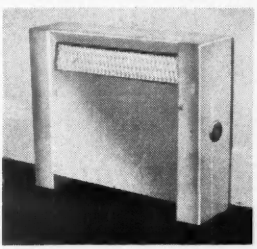


"ElRemCo" type HDD contactor

circuit comprises two large slightly domed contact studs on a "Paxolin" mounting which, when the contact is energized, are bridged by a thick copper bar. The maximum load for which the contactor can be recommended depends on the inductance of the load and frequency of operation. While for continuous rating 200 A at 24 V d.c. can be handled under suitable conditions, intermittent operation makes possible the switching of up to 450 A. The contactor can be supplied with coils for current or voltage operation provided that the voltage is under 250 V d.c.

Portable Convector

Compactness, attractive appearance and safety have been the aim of the "Snug" type



"Floodwarmth" convector introduced by UNITY HEATING, LTD., Chilworth Manor, Southampton. Of modern design and measuring only 19½in by 23½in by 6¼in, it incorporates an internal lamp-glow effect and small mesh grills providing complete safety. The loading is 750 W, models being supplied with or without thermostatic control. The standard finish is cream-gold, light green-gold, or rose-gold-pink. The price is £5 7s 6d (plus £3 19s purchase tax in the United Kingdom) without thermostatic control and £7 (plus £5 2s 11d) with.

Traffic Sign Lighting

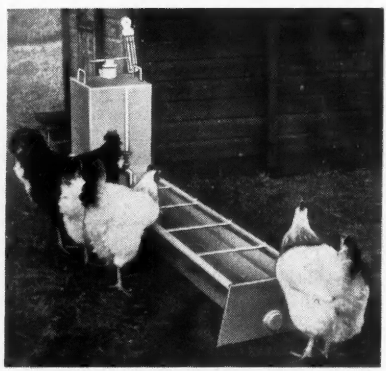
A new fluorescent lighting fitting for road traffic signs is available from FRANCO TRAFFIC SIGNS, LTD., Barnet By-Pass, Boreham Wood, Herts, in two sizes for application to large and small signs. The larger fitting is 31in wide and the width of the small fitting is 16·5in. The depth of the fitting is only 3·5in and no part of the sign is obscured by casing. The fitting is constructed from aluminium and has angle iron fixing arms, the lamp aperture being enclosed by "Perspex" or plate glass. The larger model incorporates a 30in cold cathode fluorescent lamp; the smaller one has a lamp of the same length bent hairpin fashion.

The fitting is easily fixed to posts of any diameter and the lamp can be mounted at any distance up to 18in from the face of the sign according to the area to be illuminated.

Franco cold cathode fluorescent lighting fitting for road traffic signs

Poultry Drinking Trough

THE provision of warm water for hens in open yards and other exposed positions is of great importance in the cold winter period. If drinking water is maintained at a temperature of between 50 and 60 deg F it will greatly increase the water consumption by the birds and consequently egg production at a time when egg laying is at one of its worst periods.



Warm water drinking trough for poultry

As a result of an inquiry from Mr. C. T. Riley, who is poultry adviser for Hampshire, a warm water drinking trough has been designed by Mr. J. Taylor, A.M.I.B.A.E., and Mr. A. Horrell, Associate I.E.E., Agricultural Section, Southern Electricity Board.

The trough, which is 5ft in length, contains 9 gall of water with a further supply of 9 gall in a feed tank, the total being sufficient for 200 birds daily whilst in full lay. As the water is taken by the birds it is replaced automatically from the supply tank, which can either be connected to the water main with ball valve control, filled by bucket or removed for filling.

A 400 W heating element running the full length of the trough, maintains the temperature at 50 deg F, thus ensuring that the water will not freeze. A higher temperature can be obtained by adjusting the thermostat. The equipment has been tested at Hampshire County Farm Institute, Sparsholt, near Winchester, and maintained a temperature of 54 deg F against a minimum ambient temperature of 23 deg F, with general conditions of frost and snow. The consumption based on 54 deg F is approximately 4 to 5 kWh a day. The price of the 5ft trough will be approximately £14. Further details can be obtained from local electricity service centres, or from the manufacturers, J. W. Woolley & Co., Ltd., Two Gates, Tamworth.

ELECTRICITY SUPPLY

Standard Tariffs in Eastern Area

Austro-Yugoslav Agreement

THE Eastern Electricity Board's new tariffs, which will be introduced at the end of June, will standardize charges for electricity throughout the Board's Area of approximately 8,000 square miles, replacing the many varied tariffs of former company and municipal undertakings which have been continued, apart from variations in price, since nationalization. About 90 per cent of the consumers are domestic and most have been on a two-part quarterly rate with a fixed charge based on floor area. This system will now apply throughout the Area. As an alternative there will be a block rate which will be advantageous for those with small consumptions. The following is a summary of the new tariffs:—

DOMESTIC. Two-part quarterly. Premises up to 1,200 sq ft, 15s 2d, and 4s 4d for each additional 400 sq ft, or fixed charge of £2 14s 2d for premises exceeding 4,400 sq ft. Running charge 1d/kWh.

Night and day rate. Fixed charge as above plus 13s where supply is single-phase or 19s 6d otherwise. Running charge ¾d/kWh from 9 p.m. to 7 a.m. (10 p.m. to 8 a.m. during "Summer Time").

Two-part prepayment. Weekly fixed charge 1s 5d for premises up to 1,200 sq ft and further 4d for each additional 400 sq ft, or charge of 4s 5d for premises exceeding 4,400 sq ft. Running charge 1d/kWh.

Block rate. For first 104 kWh a quarter, 6d/kWh (prepayment 6½d), next 1,040 at 1½d and thereafter at 1d.

COMBINED DOMESTIC AND COMMERCIAL. Two-part quarterly and night and day rates as for domestic (not applicable where maximum power required* exceeds 50 kVA or commercial assessed demand 5 kVA).

INDUSTRIAL AND COMMERCIAL. Maximum demand tariff. (*a*) Fixed charge of 2s a month per kVA of maximum power required where supply is at 650 V or less, or 1s 6d for higher voltage supplies. (*b*) Maximum demand charge of 11s 6d/kW of m.d. a month where maximum power required is 75 kVA or less, with sliding scale for higher demands. (*c*) Running charge of 0·6d/kWh for first 50,000, 0·5d/kWh for next 150,000 and 0·45d/kWh thereafter (for supplies above 650 V, 0·58d, 0·48d and 0·43d respectively), ± 0·0008d for each penny variation in price of fuel from basic figure of 38s.

FARM. Two-part tariff. Fixed charge for house as for domestic two-part tariff, together with farm charge of £2 18s 6d where assessed demand does not exceed 5 kVA, scaling to £27 6s between 40 and 50 kVA. Running charge 1d/kWh.

INDUSTRIAL, COMMERCIAL AND FARM. Block tariff. Rates of 6d, 1½d and 1d, the number of kWh in first two blocks varying according to maximum power required: up to 5 kVA, (1) 156 and (2) 1,560; scaling to 40–50 kVA, (1) 1,456 and (2) 14,560.

Night and day rate. Fixed charge 13s a quarter (single-phase) or 19s 6d, with kWh charges as for block rate but reduced to ¾d/kWh at night, such consumption being excluded in determining charge at other times.

* Maximum power required means maximum power which a consumer has by notice required Board to supply.

The proposed tariffs were considered by the Eastern Electricity Consultative Council at a special meeting last Friday. The report of the General Purposes Committee, which was adopted, expressed the view that, on the basis of the Board's revenue forecasts for the next two years, the prices which the Board proposed to charge were not unreasonable. The new standard methods of charge were welcomed, though it was recognized that in certain towns where low tariffs operated they would mean a substantial increase. A number of amendments had been secured and the Board had stated that it found the observations of the Council very helpful. Alderman W. J. Bennett, chairman of the Council, remarked that from the Board's figures it was evident that a sum of something like £2 million would have to be found in 1953–54. He referred to the fact that the Eastern Board had to pay more for its electricity than most of the other Boards: moreover, irrespective of their trading position they now had to contribute to the central reserve fund.

Deputation on Subvention

Having pressed for a review of its case for assistance for the Area from central funds, the South Western Electricity Consultative Council has now been informed that the B.E.A. is prepared to receive a deputation. The Council had urged that some form of subvention was necessary if tariffs in the Area were to be kept reasonably in line with those elsewhere. In the letter from the B.E.A. it was stated that the discussions would have to be on a broader basis than that indicated by the Council, which presupposed that subvention was the only solution of the problems of the South Western Board. When the matter was raised at the Council's meeting at Plymouth on 14th March the chairman, Ald. H. J. Perry, favoured exploring the possibility of aid in the form of an Exchequer grant, but Ald. A. J. West (Taunton) thought that whatever was done should be within the industry.

Southern Consultative Council

The Southern Electricity Consultative Council met in London last week under the chairmanship of Mr. A. Lockwood. The resignation was reported of Councillor G. Bravery, who is to be Mayor of Poole in the forthcoming year, and

the Council passed a resolution wishing him every success in his year of office. At its January meeting the Council had recommended to the Board that in the forthcoming financial year a fair proportion of capital allotted to new business should be devoted to agriculture, including farm workers' cottages. It happened that the Parliamentary Secretary to the Minister of Fuel and Power, Mr. L. W. Joynson Hicks, visited the Board (at about that time) and the matter was discussed at some length. Mr. Lockwood said his impression was that the Minister would take a very sympathetic view of the resolution.

Charges in S.W. Scotland

Increased electricity charges—many domestic consumers would pay 25 per cent more—are likely to come into force next June in Glasgow and the area covered by the S.W. Scotland Electricity Board. In a memorandum reviewing the Board's trading position, Mr. William Hutton, deputy chairman, said it had been hoped that the additional revenue from the new industrial and commercial tariffs would put the Board on a sound financial footing by March, 1954, but the recent increases in coal and freight charges and in the bulk supply tariff were much greater than could have been foreseen. Revised estimates indicated a deficit of £1,130,000 by 1955. The proposed tariff increases would, it was estimated, yield an additional revenue of £1,234,850 in the next three years, and it was expected that £130,000 could be obtained from normal growth of load.

Scottish Transmission Lines

The Secretary of State for Scotland has confirmed a scheme prepared by the North of Scotland Hydro-Electric Board for the erection of overhead transmission lines from Beauly in Inverness-shire to a new transforming station to be erected at Linsidecroy near Invershin in Sutherland. The new lines will extend the Board's main grid system northwards into Sutherland. The estimated cost is £552,000. The Amenity Committee recommended certain alterations in the route proposed which have been accepted by the Board. All the objections lodged against the scheme were withdrawn.

River Drave Development

At a meeting held at Bled, Yugoslavia, last month, under the chairmanship of Mr. Pierre Sevette, head of the Power Section of the United Nations Economic Commission for Europe, the representatives of Austria and Yugoslavia signed a first official protocol on the development and exploitation of hydro-electric energy furnished by the River Drave, which flows through the territories of the two countries. At present the exploitation of the two hydro plants situated on the Austrian sector of this river causes alterations in the flow which interfere with the operation of the plants on Yugoslav territory. In addition, a large number of projects have been planned, to divert tributaries or construct new works, which might well alter the character of the Drave. The protocol now finally signed between the two countries provides for measures to be taken immediately by Austria to lessen the variation in flow of the river, so as to enable the plants situated on Yugoslav territory to operate more regularly; and the establishment of a permanent joint commission, consisting of an equal number of representatives of both countries, to discuss problems relating to the development and exploitation of the Drave. The protocol also provides that Austria shall study Yugoslavia's claim for compensation for interference caused to the operation of her power plants during the last four years. It also mentions the development of electric power exchanges between the two countries, and the possibility of Austria's participation in the construction of plants in Yugoslavia. The various matters still outstanding, particularly the organization of the permanent mixed commission, will be examined by experts at a meeting to be held in May at Velden, Austria. The signing of the final protocol will probably take place in June, at the 9th session of the Committee on Electric Power.

Installation Scheme Held Up

Morpeth Town Council has been informed that owing to curtailment of capital expenditure the North Eastern Electricity Board cannot at present carry out the work of installing electricity in 422 pre-war Council houses. The Council is urging the Board to proceed with the work and has enlisted the aid of Mr. R. J. Taylor, the local M.P.

Another Collier

S. P. Austin & Sons, the Sunderland shipbuilders, have completed the collier *Hackney* (2,700 tons), the last of three vessels ordered by the British Electricity Authority. The other two, *Deptford* and *Brunswick Wharf*, were completed towards the end of last year.

Safety in Coal Mines

THE 1951 edition of the Regulations and Orders relating to Safety and Health made under the Coal Mines Act, 1911, is now available from H.M. Stationery Office (4s). It contains all the Regulations and Orders in force on 1st July, 1951, as well as the Coal Mines (Officials and Inspections) General Regulations, 1951, most of which came into force on 3rd September last. Part 4 of the volume contains lists corrected to 1st June, 1951, of approvals of certain types of certified apparatus including electrical equipment. It is to be noted that this is not a full list of apparatus which has been certified; this is now the subject of separate quarterly lists.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

The Telegraph Construction & Maintenance Co., Ltd.—The accounts for 1951 were reviewed in our last week's issue. In his statement, which accompanies the report and accounts, Lord Colgrain (chairman) says that despite the difficulties connected with the supply of raw materials, they produced a greater volume of goods and also increased the trading profits by about 70 per cent. The progress and successful trading of their subsidiaries and associated companies have continued to be most encouraging. Lord Colgrain expresses his appreciation of the excellent work done by the staff and workpeople on the Selborne Estate in Malaya despite the conditions of difficulty and danger which continue to prevail in that country. The company has continued during the year to cement and strengthen the relations with Johnson & Phillips, Ltd., and several new joint ventures are under way. Submarine Cables, Ltd., jointly owned by themselves and Siemens Brothers & Co., Ltd., continues to thrive, and but for material shortages should have had a record year.

Hilger & Watts, Ltd.—The annual meeting was held on 20th March, Mr. G. A. Whipple (chairman and managing director) presiding. In presenting the report and accounts, the chairman said that work on the new factory was progressing steadily and their present plans provided for limited production in the new premises to commence in July and for the major move to take place later in the year. Difficult trading conditions persisted, but they were fortunate in that their products had a low raw material content with a high conversion value. They were therefore viewed with special favour by the Board of Trade and other interested departments. Their associate company, Scientific Exports, would shortly be sending three specially trained university graduates to strengthen their existing technical sales staff in Canada. North America was now their largest single market. While still maintaining their export sales they were nevertheless contributing to the rearmament programme. Several new instruments had been put into production during the year and others were in course of development.

Franco Signs, Ltd., reports consolidated trading profits of £117,116 for the year to 30th September last, as compared with £70,434 for 1949-50. After deducting all charges, including £43,213 for taxation and £18,226 for depreciation, the balance attributable to interests of the parent company is £28,358 (£26,867), of which £11,037 is dealt with in the accounts of Franco Signs and £17,321 retained by subsidiaries. General reserve receives £8,150 and the dividend for the year is 7½ per cent (against 5 per cent). The group balance carried forward is £65,731 (against £56,548 brought in).

Bylock Electric, Ltd., reports a net profit for the year to 31st July last of £24,432, as compared with £1,625 for the preceding year. Taxation absorbs £15,900. It is proposed to pay a final dividend of 25 per cent, making 50 per cent for the year (against nil). The directors state that in view of the present uncertain situation they have decided for the time being not to pay an interim dividend for the current year.

Wolf Electric Tools (Holdings), Ltd., which was made public in March, 1951, reports a group profit for the nine months ended 31st December last of £234,668, and after deducting £203,831 for taxation, the net profit is £30,837. It is proposed to pay an ordinary dividend for the period at the rate of 13½ per cent per annum which for the nine months is 10 per cent actual. The balance carried forward is £6,922.

A. F. Bulgin & Co., Ltd., report a net profit for the past year of £20,737, after taxation of £65,517. This compares with a profit of £23,126 (taxation £43,200) for the preceding year. The proposed dividend for the year is 30 per cent (against 27½ per cent), and £23,530 is carried forward (against £18,543 brought in).

The Ebonite Container Co., Ltd., has declared an interim dividend of 4½ per cent (same).

New Companies

Livingston Laboratories, Ltd.—Registered 3rd March. Capital £10,000. Electronic and electrical manufacturers, wholesale merchants and repairers of and dealers in electronic, electrical, medical, surgical and scientific apparatus, etc. F. Livingston Hogg is permanent director and chairman. Regd. office : 37, Norfolk Street, W.C.2.

Ronning & Co., Ltd.—Registered 5th March. Capital £1,000. Electricians,

mechanical engineers and manufacturers, workers and dealers in electrical or other shoe dryers, etc. Directors : Daisy E. B. Rasmussen (chairman), G. B. Rasmussen, A. Skuterud, K. Englelund and R. Ronning. Regd. office : 7, York Place, Adelphi, W.C.2.

Visualease, Ltd.—Registered 12th March. Capital £100. Hire service and maintenance of television, radio, broadcast, electrical and musical goods, accessories and apparatus, etc. B. J. Benzimra is first and permanent director. Regd. office : Felgate House, Studland Street, W.6.

Rebus Electric, Ltd.—Registered 12th March. Capital £2,000. Manufacturers of and dealers in radio sets, gramophones and sound reproducing machines, etc. Directors : C. O. L. Ward and Mrs. Gladys M. Ward. Regd. office : Bank Chambers, 2, Putney Hill, S.W.15.

Goodyear Transformers, Ltd.—Registered 8th March. Capital £2,000. Manufacturers of and dealers in electrical transformers of all types, etc. Directors : H. Goodyear, S. Goodyear and R. C. Aston. Regd. office : 16, Barrington Road, Olton, Birminghem.

I. H. Rentals, Ltd.—Registered 8th March. Capital £200. Hirers and manufacturers of and dealers in electrical and mechanical apparatus and in particular television sets and equipment, etc. Directors : L. A. Desmond and Mrs. P. M. Desmond. Regd. office : 2, Corona Buildings, London Road, Swanley.

G. Cummings Electrical, Ltd.—Registered 14th March. Capital £1,000. Electrical engineers, contractors, wireless engineers, etc. Directors : G. J. E. Cummings and C. G. Bentall. Regd. office : 135, Green Lane, Ilford, Essex.

Electro Abrasives, Ltd.—Registered 15th March. Capital £10,000. Directors : J. P. Rosenberg and K. F. Rosenberg. Regd. office : 15, Avenue Parade, Accrington.

G.S.L. Products, Ltd.—Registered 15th March. Capital £1,000. Designers, patentees and manufacturers of and dealers in electrical apparatus of all kinds, etc. Directors : P. Gibson and G. S. Lisle. Regd. office : 48, Uxbridge Road, Ealing, W.5.

Valradio (Scotland), Ltd.—Registered 14th March. Capital £300. Dealers in and distributors of all kinds of electrical apparatus, including wireless and television apparatus, etc. Directors : V. Valchera, W. R. Walker and R. J. Walker. Regd. office : New Chapel Road, High Street, Feltham, Middx.

G. W. Franklin & Son, Ltd.—Registered 18th March. Capital £15,000. To acquire the business carried on at 29, Fitzroy Square, W.1, as "G. W. Franklin & Son" and to carry on the business of electrical engineers and contractors, electrical consultants, manufacturers of and dealers in electrical apparatus and goods, etc. Directors : G. W. Franklin, Maude Franklin, L. G. Franklin and Violet M. Franklin. Regd. office : 29, Fitzroy Square W.1.

Hartley Recorders, Ltd.—Registered 15th March. Capital £100. Manufacturers of and dealers in electrical, electronic and mechanical machines, instruments, apparatus and equipment, etc. Directors : A. W. M. Hartley and R. G. Cooke. Regd. office : 1a, Harrington Road, S.W.7.

Vacuum Electrical Products, Ltd.—Registered 19th March. Capital £2,000. Directors : G. K. Newman and C. J. Norris. Regd. office : 1/7, Corporation Street, Birmingham.

Liquidations

General Electrical Installations (Wilts), Ltd.—In voluntary liquidation. Meetings of members and creditors on 22nd April at 6, Broad Street Place, London, E.C.2, to receive an account of the winding up by the liquidator, Mr. L. I. Prager.

Premier Electric Services, Ltd.—Meetings of members and creditors to-day (Friday) at the offices of A. C. Palmer & Co., Court Chambers, Friar Lane, Leicester, for the purposes provided for in Section 299 of the Companies Act, 1948.

Bankruptcies

N. I. Wagstaff, residing at 145, Lodge Lane, Dukinfield, electrician, formerly carrying on business with another as "Wagstaff & Williams," electrical contractors, at 145, Lodge Lane, Dukinfield, Ches.—Trustee, Mr. F. C. Ormrod, 20, Byrom Street, Manchester, 3. Official Receiver, released 13th March, 1952.

N. H. Green, 66, London Road, Coalville, Leicester, electrician.—First and final dividend of 4s 2½d in the £, payable at the Official Receiver's office, 22, Regent Street, Park Row, Nottingham.

F. Jones and **B. P. Callaghan,** formerly trading in co-partnership at 2, Farm Yard, Levenshulme, Manchester, under the style of "Jones & Callaghan," electrical engineers and sheet metal workers.—First and final dividend of 2s 4d in the £, payable from to-day (Friday) at the Official Receiver's office, 20, Byrom Street, Manchester.

N. W. Doidge and **J. C. Stephenson,** formerly carrying on business as "Doidge & Stephenson," electrical contractors, at 16, Coldwell Street, Felling, Durham.—First and final dividend of 7s 1d in the £, payable from to-day (Friday) at the Official Receiver's office, Gibb Chambers, 54, Westgate Road, Newcastle-on-Tyne.

STOCKS and SHARES

AS can be judged from the week's fractional change in British Electricity stocks, included now in the accompanying weekly price lists, the gilt-edged market in the Stock Exchange has been fairly steady at the level to which prices were dropped initially by the latest raising of Bank Rate. The Chancellor of the Exchequer has shown clearly the intention to use interest rates as a major instrument of Government policy. It is therefore recognized that the factor upon which most investment values are based has become a flexible affair, liable to be trimmed or relaxed at short notice as may be required by changes in the economic weather. While the main economic issues remain in doubt, there is consequently no feeling of certainty about early prospects for gilt-edged securities, or for the wide range of other investments which follow their lead. But the hope is, of course, that the dearer-money process, in conjunction with the other policies, has been carried far enough to serve its purpose, and that the course of events will permit, in time, the entertaining of ideas about an easing of money conditions.

Electrical Equipment Shares

Taking a cue from the gilt-edged market, industrial share prices have not been much altered since the first recoil on the Budget proposals. With investment still showing the utmost reluctance, however, to venture into new commitments, such changes as do occur in prices reflect frequently the routine selling of securities which is always with us. Yields of close on 6 per cent from the new ordinary shares of General Electric and Imperial Chemical Industries continue to attract more than a normal share of the available buying orders, and prices in these cases are fairly well maintained. Telegraph Constructions gained a small improvement, thanks to the excellent profits statement. B.I.C. remained at 26s pending the approach of the capital issue, details of which were expected to-day (Friday).

Coming Dividends

With the Budget out of the way, and many company accounts for 1951 in the course of completion, the flow of dividend announcements and profit figures for 1951 will soon be providing markets daily with points of individual interest. A.E.I. and English Electric have already started the ball rolling, and in good style. If last year's dates are anything to go by, Lancashire Dynamo's results should be one of the next on the list. Next month announcements will be due from B.I.C., Chloride Electric, Ever Ready, Allen West, Laurence Scott, Reyrolles and C. A. Parsons; to be followed in May by some of the leaders in the cables group, Henley's, Johnson & Phillips, Siemens and Enfields.

Company News

The 1s ordinary shares of A. F. Bulgin & Co., upon which the dividend for 1951 has been raised from 27½ to 30 per cent, are quoted at a shade under 3s, so that the yield basis is now a full 10 per cent. Trading results appear from the preliminary statement to have expanded well, although a much higher tax charge leaves little change in the net figure. A 10 per cent return is shown also by the 10s shares of Franco Signs, at 7s, on the 7 per cent dividend now declared. This is a 2 per cent advance on last year, and the profits experience is similar to that of A. F. Bulgin.

Wolf Electric Tools

The dividend of 10 per cent, declared last week by Wolf Electric Tools (Holdings) in respect of the nine months to December, 1951, is at the rate of 13⅓ per cent per annum. This compares with the rate of not less than 7½ per cent foreshadowed in the particulars advertised when the 5s ordinary shares were first brought to the Stock Exchange market a year ago. Dealings began then at 6s 6d. Quoted to-day at about 9s 6d, to yield over 7 per cent on the annual rate of the dividend now declared, they have proved a profitable holding for those who took an early interest. Group profits for the period are given as £235,000, of which a net amount of £31,000 remains after tax provisions. Preference and ordinary dividends involve the distribution of £18,000. The 7 per cent preference shares are on offer at about 22s 6d and pay nearly 6¼ per cent on the money.

Brook Motors

At 32s 6d, Brook Motors 10s ordinary shares stand about the figure at which they were marketed a little less than a year ago, since when the industrial market has, of course, been in a net decline. In the interval, they have been quoted up to 38s 6d. First annual results were published towards the end of last year. They confirmed the expansion which had been forecast in the particulars advertised at the time of the introduction; the net profit, after tax, was nearly £220,000 for the year ended in September. A 20 per cent distribution on the £428,000 ordinary capital, together with the dividend on £198,000 preference stock, absorbed rather over £50,000 net between them, so that more than three-quarters of the surplus went back into the business. Turnover reached record proportions during the year, and the chairman reported a heavy order book, while calling attention to the company's dependence on supplies of steel and other metals. On the latest dividend rate, the shares pay £6 3s per cent on the money.

Electrical Investments

Past Week's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price Mar. 24 1952	Week's Rise or Fall	Est. Yield p.c.
Gilt-edged and Overseas Stocks			£ s d		
Brit. Elec. 1968/73	3	3	81½	—	3 13 7
Brit. Elec. 1974/77	3	3	80	—	3 15 0
Brit. Elec. 1976/79	3½	3½	87½	−½	4 0 0
Atlas Elec. ..	3	4	17/9	+3d	4 10 2
Calcutta Elec. ..	6†	6†	19/6	−6d	6 3 1†
East African Power	7	7	28/9	—	4 17 6
Nigerian Elec. ..	10	10	26/3	—	7 12 4
Palestine Elec. "A"	5†	5†	14/6	—	6 18 0†
Perak Hydro-Elec.	Nil	Nil	12/6	—	—
Equipment and Manufacturing					
Aberdare Cables(5/-)	20	20	11/6	−6d	8 13 10
Aerialite (1/-) ..	83⅓	88⅓	8/9	—	10 2 0
Aron Elec. Ord. ..	15	15	33/9	—	8 17 9
Assoc. Elec. Ord.	20	20	66/6	—	6 0 3
Automatic Tel.& El.	12½	15	53/9	—	5 11 6
Babcock & Wilcox	15	18	63/6	−1/-	5 14 0
Baldwin, H. J. (2/-)	25	25	5/-	—	10 0 0
British Aluminium	10	10			
B.I. Callender's ..	6⅝	7½	34/-	—	5 17 8
British Thermostat (5/-)	30	30	26/-	—	5 15 6
British Vac.Cleaner (5/-)	20	25	27/-	—	5 11 0
Brook Motors ..	20	20	13/6	−6d	9 5 2
Brush Ord. (5/-) ..	20	20	32/6	—	6 3 1
Burco (5/-) ..	10	10	5/3	—	9 10 6
Chloride El.Storage	42½	38¾	20/-	—	9 13 9
Cole, E. K. (5/-) ..	12½	15	55/-	−1/16	5 9 1
Cossor, A. C. (5/-)	20	25	15/-	—	6 13 4*
Crabtree (10/-) ..	Nil	Nil	11/-	−3d	—
Crompton Parkinson Ord. (5/-) ..	17½	17½	32/6	—	5 7 9
De La Rue (5/-) ..	11¼	11½	8/9	—	6 8 9
Decca (1/-) ..	50	50	30/-	−9d	6 3 4
E.M.I. (10/-) ..	112½	112½	16/-	—	7 0 9
Electrical Components (5/-) ..	8	12	15/-	−3d	8 0 0
Elec. Construction	20	20	11/3	—	8 17 10
Enfield Cable Ord.	15	15	47/6	—	6 6 3
English Electric ..	7½	7½	25/-	—	6 0 0
Ericsson Tel. (5/-)	15	15	52/6	—	5 14 3
Ever Ready (5/-)	22†	22†*	35/6	−9d	3 2 0†
Falk Stadelmann	35	35	24/6	−6d	7 2 9
G.E.C. Ord. ..	15	15	38/9	−1/16	7 14 9
General Cables (5/-)	17½	22½	73/9	+1/16	6 2 0
Greenwood & Batley	38	30*	17/6	—	8 11 6
Hackbridge Cable (5/-)	15	15	42/6	−1/16	7 1 2
HackbridgeHewittic (5/-)	20	20	10/3	—	9 15 0
Hall Tel. Acc. (10/-)	15	18	13/9	−1/16	6 11 0
Heatrae (2/-) ..	10	10	11/6	—	8 13 10
Henleys (5/-) ..	12½	12½	4/-	—	6 5 0
Hoover (5/-) ..	20	20	17/-	−1/-	5 17 8
Intl. Combustion (5/-)	37½	35*	25/9	+6d	6 15 8
Johnson & Phillips	20	25	20/-	−3d	6 5 0
	15	15	47/6	—	6 6 3

Company	Dividend Previous	Dividend Last	Middle Price Mar. 24 1952	Week's Rise or Fall	Est. Yield p.c.
Equipment and Manufacturing (continued)			£ s d		
Lancashire Dynamo	22½	22½	39/6	−6d	5 14 0*
Laurence, Scott(5/-)	12½	12½	10/6	—	5 19 0
London Elec. Wire	10	10	37/6	—	5 6 8
J. Lucas	17½	7½*	30/9	—	4 17 5
Mather & Platt ..	12½	12½	39/6	−1/16	6 6 7
Metal Industries ..	10	10	35/-	—	5 14 3
Mid. Elec. Mfg. ..	15	15	53/9	—	5 11 6
Murex	10	12½	42/6	−3/-	5 17 8
Newman Ind. (2/-)	10	6	2/9	—	—
Oldham & Son (1/-)	30	30	4/3	—	7 1 3
Parsons, C. A. ..	15	15	46/3	—	3 4 8*
Plessey (5/-) ..	20	22½	16/3	−1/16	6 18 6
Pye Deferred (5/-)	35	18*	16/-	—	5 12 6
Revo (10/-) ..	27½	27½	32/6	—	8 9 3
Reyrolle	15	15	40/9	−6d	3 13 6*
Scot. Cable (4/-) ..	30	30	19/3	−6d	6 4 8
Siemens Ord. ..	7½	10	32/-	−6d	6 5 0
Switchgear & Cowans (5/-)	22½	22½	13/-	—	8 13 3
T.C.C. (10/-) ..	15	20	46/-	—	4 7 0
T.C. & M. ..	10	10	34/6	+3d	5 16 0
TelephoneMfg.(5/-)	10	10	7/3	−3d	6 18 0
Thorn Elec. (5/-)..	20	10*	7/9	—	6 9 0
Tube Investments	25	25	4¼	−1/16	5 2 6
Vactric (5/-) ..	Nil	Nil	7/-	—	Nil
Veritys (5/-) ..	2½	Nil	3/6	—	Nil
Walsall Conduits (4/-)	70	70	48/-	−9d	5 16 8
Ward & Goldstone (5/-)	44	45*	36/3	—	6 0 0
Watford (2/-) ..	20	25	5/9	—	8 14 0
Westinghouse Brake	14	14	44/6	−1/-	6 6 2
West, Allen (5/-)	10	12½	9/9	−3d	6 8 2
Transport and Communications					
Anglo-Am. Tel.: A Ord.	—	—	84½	—	—
Ord.	—	—	58	—	—
Anglo-Portuguese	8	8	21/3	—	7 10 7
Brit. Elec. Traction: Def. Ord. ..	22½	25	345	−20	7 4 9
Cable & Wireless: Ord.	6	8	111½	−2	7 3 5
4% Loan ..	4	4	95	+½	4 4 3
Calcutta Trams ..	6†	6†	23/-	—	5 4 4†
Cape Elec. Trams	4	5	14/-	—	7 2 9
Globe Tel. & Tel. Ord.	—	—	25/-	—	—
Inter. Tel. & Tel.	Nil	15cts	32	−2	—
Marconi Marine ..	7½	10	25/-	−3/16	8 0 0
Oriental Tel. Ord.	16	16	46/3	—	—
Telephone Props.	7	8	28/9	−1/16	5 11 4
Tele. Rentals (5/-)	10	10	7/3	−3d	6 18 0

* After capital bonus.
† Dividends are paid free of Income Tax.

NEXT WEEK'S EVENTS

Monday, 31st March

BIRMINGHAM.—James Watt Memorial Institute, 6 p.m. I.E.E. South Midland Centre. "The Economics of Low-Voltage Electricity Supplies to New Housing Estates," by F. G. Copland.

BOURNEMOUTH.—Grand Hotel, Firvale Road, 8.15 p.m. A.S.E.E. Bournemouth Branch. "Applications and Characteristics of A.C. Motors," by F. T. Bartho.

BRISTOL.—S.W.E.B. Offices, Colston Avenue, 6 p.m. I.E.E. Western Utilization Group. Conference on "Electricity as an Aid to Productivity."

IPSWICH.—Crown & Anchor Hotel, 6.30 p.m. Institution of Electrical Engineers. District meeting. "Domestic Electrical Installations: Some Safety Aspects," by H. W. Swann.

LEEDS.—At the Lighting Service Bureau, 24, Aire Street, 7 p.m. I.E.S. Leeds Centre. "Light and Sight," by J. Benson.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Informal meeting. Discussion on "Statistics as Applied to Engineering," opened by W. A. Carne.

NEWCASTLE-ON-TYNE.—King's College, 6.15 p.m. I.E.E. North-Eastern Radio & Measurements Group. Annual general meeting. "The Design and Testing of an Electronic Servo-Simulator for a Hydraulic Remote Position Controller," by F. J. U. Ritson and P. H. Hammond.

NORWICH.—Royal Hotel, 7.30 p.m. Institution of Electrical Engineers. District meeting. Informal lecture on "The Nervous System as a Communication Network," by J. A. V. Bates.

Tuesday, 1st April

CAMBRIDGE.—Cavendish Laboratory, 8.15 p.m. I.E.E. Cambridge Radio Group. "Radio Astronomy," by K. E. Machin.

CARDIFF.—At the South Wales Institute of Engineers, Park Place, 6 p.m. I.E.E. Western Utilization Group. Conference on "Electricity as an Aid to Productivity."

South Wales E.B. Demonstration Theatre, 5.45 p.m. I.E.S. Cardiff Centre. "Safety and Vision—Industrial Lighting," by E. W. Murray.

GLASGOW.—At the Institution of Engineers & Shipbuilders, 39, Elmbank Crescent, 7 p.m. I.E.E. Scottish Centre. "Inherent Current, Voltage and Speed Control in Dynamo-Electric Machinery," by J. C. Macfarlane, Dr. J. W. Macfarlane and W. J. Macfarlane.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre. "The Sutton Coldfield Television Broadcasting Station," by P. A. T. Bevan and H. Page.

LIVERPOOL.—Merseyside & North Wales E.B. Service Centre, Whitechapel, 6 p.m. I.E.S. Liverpool Centre. "New Discharge Lamps—The Extension of the Gas Arc Condition," by H. W. Cumming.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurements Section. Discussion on "The Specification and Measurement of Performance in Servo Mechanisms," opened by Prof. A. Tustin and J. F. Coales.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Centre. "Domestic Electrical Installations: Some Safety Aspects," by H. W. Swann.

RUGBY.—College of Technology & Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. Annual general meeting. "The Planning of an Electricity Board's Distribution System," by G. O. McLean.

Wednesday, 2nd April

BRIGHTON.—Technical College, 6.30 p.m. I.E.E. Southern Centre. "Inhibited Transformer Oil," by W. R. Stoker and F. N. Thompson. "Stability of Oil in Transformers," by P. W. L. Gossling and L. H. Welch.

LIVERPOOL.—A.S.E.E., Liverpool Branch. 7.30 p.m. Visit and lecture at the works of the Liverpool Electric Cable Co., Ltd.

LONDON.—I.E.E. London Students' Section, 2.30 p.m. Visit to British Insulated Callender's Cables, Ltd., Erith Works, Belvedere, Kent.

At the Institution of Mechanical Engineers, Storey's Gate, S.W.1, 6 p.m. Institution of Heating & Ventilating Engineers. Discussion on "Education and Recruitment for the Heating and Ventilating Industry," introduced by N. S. Billington.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Radio Group. "High-Gain d.c. Amplifiers," by W. Kandiah and D. E. Brown.

MIDDLESBROUGH.—Cleveland Scientific & Technical Institute, Corporation Road, 6.30 p.m. I.E.E. Tees-Side Sub-Centre. Annual general meeting. "Electricity in Newspaper Printing," by A. T. Robertson.

NEWCASTLE-ON-TYNE.—Minor Durrant Hall, Oxford Street, 6.15 p.m. I.E.S. Newcastle Centre. Annual general meeting, followed by E.D.A. film on lighting.

WOOD GREEN.—Three Jolly Butchers Hotel, 8.15 p.m. A.S.E.E. North London Branch. "Fluorescent Lamps and Lighting," by A. D. S. Atkinson.

YORK.—Creamery Restaurant, Pavement, 7.30 p.m. A.S.E.E. York Branch. "Light and Colour," by J. W. Howell.

Thursday, 3rd April

BATH.—Electricity Showrooms, 7 p.m. I.E.E. Bristol Students' Section. Short papers evening.

CROYDON.—Café Royal, North End, 8 p.m. A.S.E.E. South London Branch. Discussion on "General Installations."

LEEDS.—1, Whitehall Road. Electrical Power Engineers Association, West Yorkshire Technical Group. Annual meeting. Film, "The Nature of Plastics."

LIVERPOOL.—At the Royal Institution, Colquitt Street, 6.30 p.m. I.E.E. Mersey & North Wales Centre. Annual general meeting. Discussion on "Should Broadcasting be Superseded by Wire Distribution?", opened by P. P. Eckersley.

[*Continued on next page*

Thursday, 3rd April (*Continued*)

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. "A Logical Approach to the Problems of Electric Space Warming," by D. H. Parry. (Utilization Section paper.)

Imperial College and Huxley Building, South Kensington. Physical Society Exhibition. (Until 8th April.)

At the London School of Hygiene & Tropical Medicine, Keppel Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers. Discussion on "V.H.F. and U.H.F. Broadcasting," opened by the president, P. Adorian.

MANCHESTER.—Town Hall Extension, 6 p.m. I.E.S. Manchester Centre. "Fluorescent Lamps for Lighting Stage and Auditorium," by J. W. Strange.

NOTTINGHAM.—E.M.E.B. Demonstration Theatre, 5.30 p.m. I.E.S. Nottingham Centre. "Artificial Lighting for Cinema Studios," by E. J. G. Beeson.

TYTHING.—Talbot Hotel, 7.15 p.m. Worcester Electric Club. "Factory Electrical Installations," by E. Bayliss.

Friday, 4th April

BRISTOL.—Royal Hotel, College Green. I.E.S. Bath and Bristol Centre. Annual luncheon and presidential address.

LONDON.—Connaught Rooms, Great Queen Street, W.C.2, 6 for 6.30 p.m. Association of Supervising Electrical Engineers. Annual dinner and reunion.

Storey's Gate, S.W.1, 5.30 p.m. Institution of Mechanical Engineers. "Some Considerations Regarding a Factory Maintenance Engineering Department," by M. Bentham.

SHEFFIELD.—Royal Victoria Hotel, 7.30 for 8 p.m. I.E.E. Sheffield Sub-Centre. Annual dinner-dance.

Electric Mill Control

THE first meeting of members of the Institution of Electrical Engineers ever to be held at Banbury and, it is thought, the first meeting of a like professional body to be held in the town within memory, drew a large attendance on Wednesday evening, 12th March. The business of the meeting included the presentation of a paper on "Modern Electrical Controls at the Rogerstone Mills," by Mr. P. E. Peck (British Thomson-Houston Co., Ltd.), who was responsible for installing the control equipment in the Northern Aluminium Company's new mill in South Wales. The meeting was also made an occasion for social contact during tea and the speaker's supper that followed.

The meeting was opened by Dr. E. G. Stanford, representative of the Banbury district on the Rugby Sub-Centre Committee. He introduced Dr. J. H. Walker, chairman of the Sub-Centre, who gave a short talk on its development and the range of its activities, in which he explained that within the last year the Banbury district had been brought within the boundary of the Rugby Sub-Centre area and that according to normal practice it was hoped to hold a meeting there annually. Mr. G. S. C. Lucas, member of the Council, next described the work of the Institution as a whole, referring also to the formation of the Sub-Centre.

Mr. Peck began his lecture by outlining, with the aid of lantern slides, the layout of the Rogerstone Mill, which includes a hot line for the continuous rolling of aluminium strip from ingots weighing 4,000 lb each, and cold rolling and finishing plant. It was shown, and emphasized in the discussion later, that the great ingenuity with which the scheme was planned had been taxed by using three existing mills, suitably modified, in making up the hot line of four mills. The cold rolling and finishing plant was unique in the industry chiefly on account of its high speed of operation and the extensive use of electrical automatic regulating and controlling devices which made high speed and "streamlining" of production possible; cold rolled sheet passed through the final stand of the tandem cold mill, for example, at speeds of up to 2,000 ft/min, and the synchronization of roll speeds to accommodate different thicknesses of strip at each stand had its problems. The speaker, after his general survey, dealt with individual units of the plant in turn, outlining their particular control requirements. The complex electrical circuits of each unit were clarified by the copious use of photographs and diagrams.

Several members took part in the discussion that followed, among them employees of the Northern Aluminium Co. who had been engaged in planning the mill. At the close a vote of thanks was proposed by Mr. J. Preston, assistant engineer, Banbury Works.

At the speaker's supper the chairman thanked Dr. Stanford for his work in organizing the meeting.

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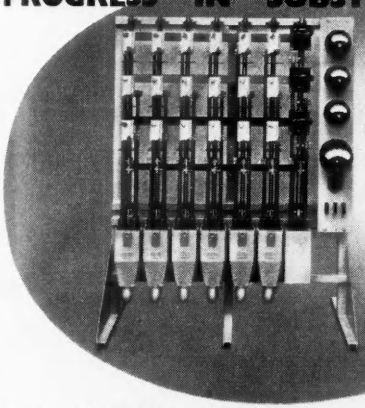

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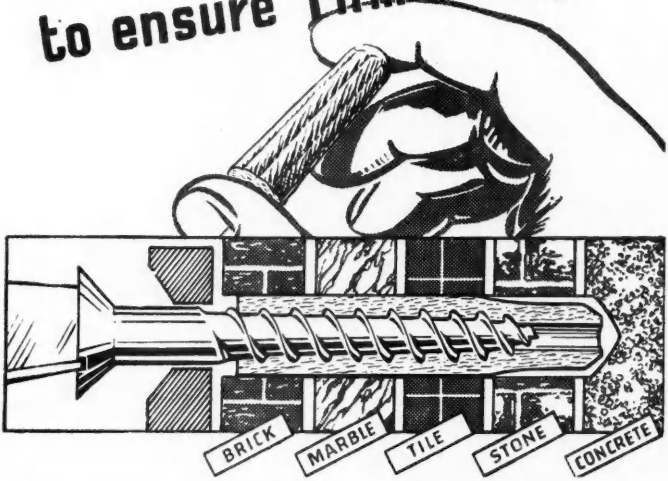

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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 7th May from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1945

2035. Bendix Aviation Corporation.—Electrical induction devices such as synchro-units, alternating current generators or motors. 8th August, 1945. (671632.)

1947

2856. Bendix Aviation Corporation.—Electromagnetic induction services. 8th August, 1945. Divided out of 671632. (671636.)

1948

441. Metcalf, H.—Electrically operated control devices. 8th February, 1949. (671355.)

14328/9. Westinghouse Electric International Co.—Regulating systems for dynamo-electric machines. 27th May, 1948. (671645/6.)

18300. Marconi's Wireless Telegraph Co., Ltd., Brandon, E. S., and Dawson, L. H.—Radar systems. 22nd April, 1949. (671461.)

20623. Marconi's Wireless Telegraph Co., Ltd., Brandon, E. S., Rust, N. M., and Dawson, L. H.—Radar systems. 21st July, 1949. Addition to 671461. (671464.)

21821. Maschinenfabrik Heid Akt.-Ges.—Electric tracer control device for machine tools. 22nd September, 1948. (671465.)

27386. Sperry Corporation.—Distance-measuring systems employing electromagnetic waves. 21st October, 1948. (671661.)

27753. Bendix Aviation Corporation and Cleveland, F. J. (Bendix Aviation Corporation).—Electromagnetic induction devices such as synchro-units or alternating generators or motors. 24th November, 1948. Divided out of 671636. (671649.)

1949

1059. Pye, Ltd., and Fuller, D. Q.—Apparatus for testing an electromagnetic wave to ascertain its spectral composition particularly for colour selection. 6th January, 1950. (671369.)

6593. Parsons & Co., Ltd., C. A., and Iliffe, C. E.—Contra-flow heat exchangers. 8th June, 1950. (671375.)

7365. Airmec Laboratories, Ltd.—Electrical counting and measuring apparatus. 10th January, 1950. (671377.)

8157. Standard Telephones & Cables, Ltd.—Amplitude modulation of magnetron. 25th March, 1949. (671469.)

8899. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Electron discharge tubes used in television or the like. 1st April, 1949. (671472.)

8904. Standard Telephones & Cables, Ltd., Welch, P., and Richards, W.—Glass bases for hermetically sealed envelopes of electric discharge devices. 1st April, 1949. (671473.)

9063. Electric & Musical Industries, Ltd.—Radio transmitting or receiving apparatus. 3rd April, 1950. (671672.)

9528. General Electric Co., Ltd., and Willoughby, A. H.—Electric discharge lamps for producing intense flashes of light. 26th May, 1950. (671384.)

12533. Fielden (Electronics), Ltd., and Fielden, J. E.—Recording and/or control apparatus. 1st May, 1950. (671389.)

13129. Ruston & Hornsby, Ltd., and Feilden, G. B. R.—Gas-turbine power plant. 17th May, 1950. (671396.)

17205. Western Electric Co., Inc.—Telephone switching systems. 29th June, 1949. (671679.)

17206. Western Electric Co., Inc.—Receiving apparatus for telephone calling impulses. 29th June, 1949. (671407.)

17453. Stevens, A. H. (Ohio Crankshaft Co.).—Control circuits for electrical power equipment. 1st July, 1949. (671410.)

19354. British Thomson-Houston Co., Ltd., and Scott, W. J.—Gaseous electric discharge devices. 7th June, 1950. (671414.)

20694. Western Electric Co., Inc.—Telephone terminal station equipment. 9th August, 1949. (671419.)

21299. Philips Electrical, Ltd.—Travelling-wave electronic discharge tubes. 16th August, 1949. (671422.)

24511. General Electric Co., Ltd.—Electronic equipments for forming electric pulse trains. 4th September, 1950. (671433.)

24913. Lockwood, L. P.—Electric fuse units adapted for outdoor pole mounting. 8th August, 1950. (671434.)

25179. Westinghouse Electric International Co.—Electrostatic precipitators. 30th September, 1949. (671436.)

25455. English Electric Co., Ltd.—Dual fuel (gas-diesel) internal-combustion engines. 29th September, 1950. (671438.)

27120. United-Carr Fastener Corporation.—Electric lamps and lens assemblies therefor. 21st October, 1949. (671487.)

27401. Electric Construction Co., Ltd., and Milne, J. C.—Electric motor control systems. 27th September, 1950. (671542.)

27898. Ekco-Ensign Electric, Ltd., and Stickley, W. A.—Electric discharge lamps. 31st October, 1950. (671444.)

27941. Strong, C. L.—Apparatus for carrying out electrotherapeutic treatments. 27th October, 1950. (671695.)

27942. Strong, C. L.—Electrotherapeutic apparatus. 16th October, 1950. (671445.)

29369. Sylvania Electric Products, Inc.—Automatic lead wire threading apparatus. 16th November, 1949. (671492.)

32113. British Thomson-Houston Co., Ltd.—Electric discharge devices. 14th December, 1949. (671700.)

33116. British Insulated Callender's Construction Co., Ltd., and Brigg, J. E.—Cleat suitable for supporting electric cables. 28th December, 1950. (671701.)

1950

645. Metropolitan-Vickers Electrical Co., Ltd.—Electronic circuit arrangements. 28th December, 1950. (671535.)

1197. Westinghouse Electric International Co.—Protective systems for commercial frequency electric power transmission systems. 17th January, 1950. (671708.)

1699. Westinghouse Electric International Co.—Electric motor control systems. 23rd January, 1950. (671560.)

3288. Metropolitan-Vickers Electrical Co., Ltd.—Inert-gas arc welding. 8th February, 1950. (671724.)

3359. British Thomson-Houston Co., Ltd.—Electrical heating devices. 9th February, 1950. (671725.)

3492. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Centralized remote control selective receiving devices. 10th February, 1950. (671568.)

4605. Soc. Anon. de Telecommunications.—Connection devices for electric cables. 22nd February, 1950. (671572.)

5211. Pyrometrie Industrielle.—Electric circuits. 1st March, 1950. (671734.)

5293. Electric Storage Battery Co.—Compositions for sealing electric storage batteries. 2nd March, 1950. (671735.)

5599. British Thomson-Houston Co., Ltd., Robinson, T. F., and Dyer, G. H.—Terminal constructions for the end caps of capacitor containers. 11th December, 1950. (671583.)

6128. Marconi's Wireless Telegraph Co., Ltd.—Radar systems. 29th November, 1950. (671737.)

6286. Hauriot, R.—Electrical control means for lancets. 13th March, 1950. (671497.)

6808. Joksch, R., and Grunberg, F.—Electrical safety device for motor vehicles driven by an internal-combustion engine. 18th March, 1950. (671742.)

6872. Webster, C. J., and Anson, W. E.—Cable clamps. 20th March, 1950. (671743.)

7447. Philco Corporation.—Sawtooth-current generator. 24th March, 1950. (671504.)

7590. Westinghouse Electric International Co.—Electric motor control systems. 27th March, 1950. (671591.)

7780. Marconi's Wireless Telegraph Co., Ltd.—Wheatstone and similar bridge circuits. 16th November, 1950. (671506.)

7823. Electric Storage Battery Co.—Apparatus for assembling storage battery elements. 29th March, 1950. (671751.)

8127. Westinghouse Electric International Co.—Electronic phase shift apparatus. 4th April, 1950. (671594.)

8472. Micafil, Ltd.—Electrical condensers. 4th April, 1950. (671511.)

8539. Electric Storage Battery Co.—Apparatus for assembling storage battery elements. 5th April, 1950. (671756.)

8986. Allmanna Svenska Elektriska Aktiebolaget.—Maximum demand indicator and regulator. 12th April, 1950. (671595.)

9825. Libbey Owens-Ford Glass Co.—Controlling resistivity of electrically conducting films. 21st April, 1950. (671767.)

10272. Philips Electrical Industries, Ltd.—Methods of manufacturing glass objects. 26th April, 1950. (671772.)

10491. Electrolux, Ltd.—Nozzles for vacuum cleaners. 28th April, 1950. (671604.)

11244. Davidson & Co., Ltd., and MacFarlane, D.—Multi-stage fans, pumps and the like. 5th May, 1950. (671607.)

11512. Westinghouse Electric International Co.—Electrical apparatus provided with gaseous insulating atmospheres. 9th May, 1950. (671780.)

12045. Standard Telephones & Cables, Ltd.—Telephone subscriber sets. 15th May, 1950. Addition to 655774. (671784.)

12696. Trubert, R. E. L., Trubert, M. H., and Russell, M. W.—Electric resistance heating devices for liquids. 22nd May, 1950. (671611.)

12916. Steatite Research Corporation.—Ferromagnetic bodies having high insulating properties. 23rd May, 1950. (671788.)

13362 & 4. Landis & Gyr Akt.-Ges.—Electric remote control receiving apparatus. 26th May, 1950. (671789/0.)

13937. Electric Furnace Products Co., Ltd.—Reduction of chromium oxide and the production of chromium-containing steels and alloys. 5th June, 1950. (671616.)

14094. Hoover, Ltd.—Suction cleaners. 6th June, 1950. (671618.)

14985. Smitsvonk, N. V.—Electrical ignition systems. 15th June, 1950. (671794.)

15590. British Thomson-Houston Co., Ltd.—Electric drive motors of automatic washing machines and the like. 21st June, 1950. (671623.)

16921. British Thomson-Houston Co., Ltd.—Vented shaft sealing devices. 6th July, 1950. (671625.)

16923. British Thomson-Houston Co., Ltd.—Magnetic iron cores. 6th July, 1950. (671802.)

16925. British Thomson-Houston Co., Ltd.—Tone arms. 6th July, 1950. (671803.)

17305. Westinghouse Electrical International Co.—Induction heating apparatus. 11th July, 1950. (671805.)

18149. British Thomson-Houston Co., Ltd.—Electric welding control systems. 20th July, 1950. (671628.)

18799. Plessey Co., Ltd.—Electrolytic condenser. 27th July, 1950. (671809.)

18894. Standard Telephones & Cables, Ltd. (Material Telephonique Soc. Anon.).—Amplitude modulation devices for very wide frequency band with carrier suppression. 28th July, 1950. (671518.)

19022. Bosch Ges., R.—Electric condensers. 31st July, 1950. (671519.)

25282. British Thomson-Houston Co., Ltd.—Washing machines. 17th October, 1950. (671540.)

29190. Patelhold Patentverwertungs- & Elektro-Holding Akt.-Ges.—Electron emitting electrodes. 29th November, 1950. (671529.)

29883. British Thomson-Houston Co., Ltd.—Composite sintered metal powder articles. 6th December, 1950. (671543.)

31033. British Thomson-Houston Co., Ltd.—Flat irons. 20th December, 1950. (671545.)

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 12th April:—

TUNGVAC. No. 704,464. Class 6. Tungsten wire included in Class 6.—Tungsten Manufacturing Co., Ltd., 68, Victoria Street, London, S.W.1.

CAPINVAR. No. 690,592. Class 9. Electrical apparatus and instruments and parts of all such goods, all included in Class 9.—Compagnie Générale d'Electro-Céramique, Paris, France. Address for service, c/o Marks and Clark, 57 & 58, Lincoln's Inn Fields, London, W.C.2.

R. RHEEM (design). No. B695,749. Class 11. Heating apparatus and installations, evaporative air-cooling apparatus, electric fans and water-softening apparatus and installations.—Rheem Manufacturing Co., Richmond, California, U.S.A. Address for service, c/o Pollak, Mercer & Tench, 134, Cheapside, London, E.C.2.

BOOKS RECOMMENDED BY

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CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—BRISBANE.—9th May. City Council. Supply of 540 lightning arrestors. (C.R.E. 10489/52. Ten/3731.)* 13th June. Supply of 11 kV outdoor type tee-off fuse switchgear and 250 MVA h.r.c. fuses. (C.R.E. 10541/52. Ten/3741.)*

Belfast.—25th April. Electricity Department. Road transport weighbridge and condensate chemical treatment plant. (See this issue.)

Birmingham. — 21st April. Corporation. Electrical installations in 12 blocks of flats and supply and erection of 14 passenger lifts at Ward End Hall estate. (See this issue.)

Blackpool.—5th April. Corporation. One 10 cwt commercial chassis and one sectional tower body. (See this issue.)

Chadderton.—5th April. U.D.C. Supply of electric lamps for one year. Surveyor, Town Hall.

Coventry.—2nd May. Corporation. Electrical installation at the Central College of Art and Technology. (See this issue.)

Lincolnshire.—1st May. Kesteven County Council. Electrical work at new infants' school, Grantham. (See this issue.)

Merton and Morden.—7th April. U.D.C. Street lighting equipment. (See this issue.)

Pakistan.—KARACHI.—16th April. Government Department of Supply and Development. Supply of 14 diesel alternators for power stations at Chittagong, Khulna and Siddhirgunj. (C.R.E. 9931/52. Ten/3726.)* 21st April. Supply of a.c. and d.c. meters. (C.R.E. 8852/52. Ten/3729.)* 7th April. Director General, Department of Supply and Development. Three 350 kVA, seven 250 kVA, two 125 kVA and one 100 kVA transformers. (C.R.E. 10651/52. Ten/3740.)*

Sedgley. — 16th April. U.D.C. Street lighting equipment. (See this issue.)

Uganda.—Electricity Board. Low voltage cable installation complete with accessories including erection and connecting up of switchgear and other equipment for the Owen Falls hydro-electric power station. (See this issue.)

Wakefield.—14th April. Corporation. Street lighting equipment. (See this issue.)

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

ORDERS PLACED

Bradford.—City Council. Work in connection with the installation of electricity in 288 houses on the Buttershaw estate, Scheme 10 (£8,799).—Shann & Bell, Ltd. Electrical installation at Margaret McMillan Training College (£2,045).—W. Beaumont Parker.

Fleetwood. — Corporation. Recommended. Electrical installations in 82 houses on the West View estate (£2,399).—A. G. Coleman.

Hull.—Corporation. Installation of electric lighting at Daltry Street School (£1,185).—Booker & Tarran, Ltd.

Electrical installations in 43 dwellings on Bilton Grange estate (£1,261).—Howdenshire Electrical Contractors, Ltd.

London. — METROPOLITAN WATER BOARD.—Switchgear, conduits, wiring, lamps, motors, telephones, etc., at Board's Ashford Common Works (£75,406).—George E. Taylor & Co. (London), Ltd.

Thornaby-on-Tees.—Town Council. Electrical installations in 78 houses at Thornaby Grange (£1,780).—W. S. Wilkes.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alnwick.—Houses (190) for R.D.C.; T. J. Cahill, Lloyds Bank Chambers.

Ashington (Northumberland).—Houses (194), Darnley Road estate; surveyor, U.D.C. Offices.

Basildon. — Factory; Darham Industries (London), Ltd., 31, Old Manor Lane, S.E.16.

Bolton.—Dwellings (306), Oldhams Farm estate; director of housing.

Bristol.—Three-storey building on site in Crow Lane, Henbury; Greater London Properties, Ltd., 22, Conduit Street, London, W.1.

Carlisle.—Additional factory premises; J. K. Innes & Co., Ltd., Kingmoor Road.

Castle Ward.—Houses (100), Ponteland; R.D.C. surveyor, North Road, Ponteland.

Cheadle (Staffs).—Maternity accommodation at Isolation Hospital; Ball & Robinson, Trent Bridge, Stoke-on-Trent.

Chester.—Further 20 houses at Dunham Hill for R.D.C.; L. O. G. Williams, The Gables, Elton.

Chester-le-Street. — Houses (260) at Kibblesworth and Sacriston for R.D.C.; F. Bowman, architect, Estate Office, Great North Road, Birtley.

Coventry.—New kitchen and dining room at Coventry and Warwickshire Hospital; Turriff Construction Co., Ltd., Leamington Spa.

Crompton.—Extensions to public baths, Farrow Street, Shaw; G. R. Hinton, clerk to U.D.C., Town Hall, Shaw, Oldham.

Croydon. — Factory, King Henry's Drive; Twentieth Century Electronics, Ltd., Dunbar Street, London, S.E.27.

Darlington.—Houses (35), Heighington, for R.D.C.; Hutton & Hutton, architects, 24, Southend Avenue.

Dewsbury.—Houses for T.C.: Wakefield Road site (108); Harlow & Milner, Ltd., Warren Yard, Warrengate, Wakefield. Staincliffe Road site (24); S. Armitage & Sons, Ltd., 62, Town Street, Leeds.

Dudley.—Houses (178), on sites at Coseley and Dudley Wood; F. H. Gibbons, borough surveyor, Council House.

Durham.—Flats in the New Elvet area; city engineer.

Eston.—Houses (134), Redcar Road East, for U.D.C. Builders: A. Payne, Gordon Road, Redcar (10); Hudson Brothers, Fidler Street, Middlesbrough (54); and Gray & Son, Ltd., Chapel Street, Thornaby-on-Tees (70).

Fleetwood.—Houses (70), West View estate; borough surveyor.

Friern Barnet.—Primary school, Coppetts Road (£58,560); R. Hart & Sons, Ltd., builders, 121, Victoria Street, London, S.W.1.

Gateshead.—Houses (400); borough architect, Town Hall.

Harrogate. — Houses (64), Grove House estate; borough surveyor, Municipal Offices.

Hertfordshire.—Schools at Barnet Lane, Barnet (£219,880), L.C.C. estate, Boreham Wood (£157,735), Park Lane, Waltham Cross (£54,340), Bevan estate, East Barnet (£51,550), and at Archers Way, Letchworth (£49,318); O. Brewerton, county architect.

Hinckley.—Houses (40); Council's architect, Council Offices, Hinckley, Leics.

Ilfracombe.—Flats (24), Slade Valley Road; U.D.C. surveyor.

Ince-in-Makerfield. — Dwellings (120), Battersby Street site; R. Lewis, U.D.C. surveyor, Town Hall.

Leamington Spa. — Houses: Whitnash estate (40), Edinburgh Crescent, Kingsway (6), and East Dene, Lillington estate (22); borough engineer.

Leeds.—Four blocks of 12 flats, and 16 houses, Reuben Street (Camp Road) area; city architect.

Leicester.—Developments at General Hospital for Sheffield Regional Hospital Board; Pike & Prince, architects, 1, West Street.

Houses (154), Eyres Monsell estate; J. S. Fyfe, housing architect, Municipal Offices, Charles Street.

Liverpool.—Twelve-storey block of 112 flats at Sparrow Hall estate, Fazakerley; city architect.

London. — GREENWICH. — Flats (18), Invicta Road; borough engineer.

LAMBETH.—Dwellings (104), Solon New Road; Rush & Tompkins, builders, 109, Station Road, Sidcup.

NEW CROSS.—X-ray department at General Hospital, Avonley Road; South East Metropolitan Regional Hospital Board, 27, Queen Anne Street, W.1.

SOUTHWARK. — Rebuilding premises; Frank Tyler & Co., Ltd., 107/111, Newington Butts.

Manchester.—New factory, Miles Platting, for F. Sheldon; E. E. Costello, architect, 325, Langworthy Road, Salford.

Mansfield.—Administration block at Portland Training College; Ford & Weston, Ltd., Osmaston Road, Derby.

Newcastle-on-Tyne. — Mineral water factory for Fentimans Direct Supply Co.; J. G. Cowe, Central Chambers, Chester-le-Street, Durham.

Occupational centre for mental defectives, City Road; city architect, 18, Cloth Market.

Plymouth.—Technical college building and engineering block; city architect.

Reading.—Houses (40), Bath Road; R. J. Haddock, Ltd., Kidmore End Road.

Risca.—Houses (58), Manor Road site; O. Morgan, U.D.C. surveyor, Risca, Mon.

Saffron Walden.—Houses (30), on four sites; town clerk, Municipal Offices.

Sandbach.—Houses (36), site off Crewe Road; H. J. Rees, U.D.C. surveyor, Council Offices, Crewe Road.

Scarborough.—Houses (70) at Eastfield for the T.C. Builders: E. Hunter, Ltd., Beaconsfield Street, Scarborough (34), and Mollekin Brothers, West Parade Road, Scarborough (36).

Sheffield.—Maud Maxfield special school for the deaf; Ackroyd & Abbott, builders, Willoughby Street, Sheffield.

Walsall.—Houses (12), Beddows Road; H. Tomlinson & Son, Birchills Street.

Washington (Co. Durham). — Pithead baths, Glebe Colliery, for the N.C.B.; Architects' Department, Ashfield Towers, Gosforth, Northumberland.

Watford.—R.C. secondary school, Garston; Archard, Worror & Hardy, architects, 20, Lowndes Street, S.W.1.

Wisbech.—Factory and offices, Weasenham Lane; Metal Box Co., Ltd., The Langham, Portland Place, W.1.

Woking.—Houses (104), in nine contracts, Grove Barrs estate, Horsell; H. P. Tame, U.D.C. surveyor, Council Offices.

Wordsley. — Building work at Hospital (£11,620); A. H. Guest, Ltd., Coalbourne Brook, Stourbridge.

Worthing.—Houses (36), Strand Road; Field Place (Builders), Ltd., 132, Goring Road.

Houses (52), Sompting; R.D.C. surveyor, Mill Road.